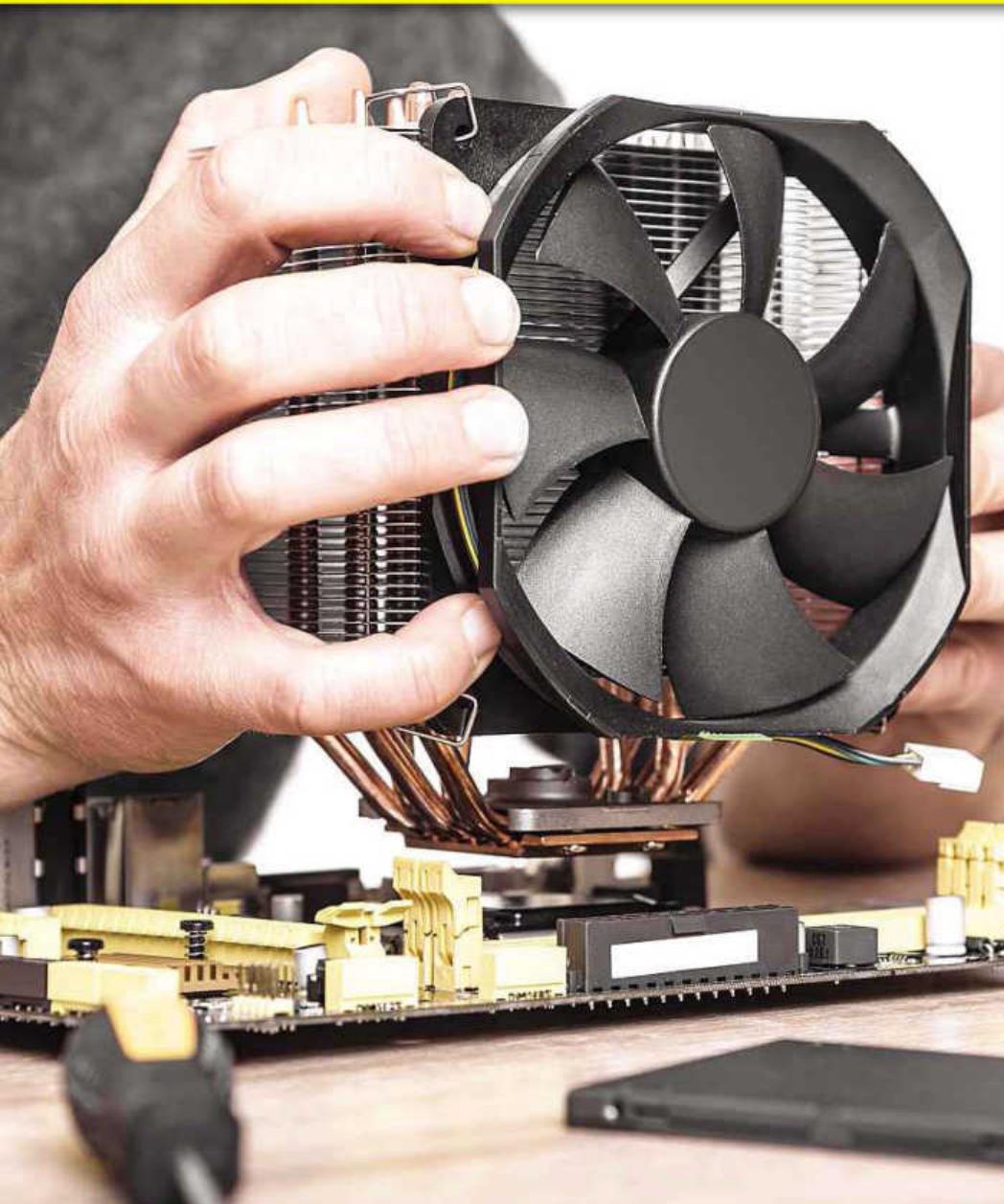NAS BOXES
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Also In This Issue…

HOW TO GET THE BEST VALUE UPGRADES

When it comes time to refresh your PC, quite often it's all about value for money

When it comes to upgrading your PC, you naturally want to make sure you get the best performance hike for your money. Unless you've got thousands of pounds to spend, there's always a trade-off to make between what's best for your system and what's best for your wallet.

To make your upgrade count, you need to spend your money wisely to find the best value components around. We've taken in various factors such as value, lifespan and overall cost to come up with what we think is a list of the best value upgrades you can make to your system, as well as how and why you might want to choose them. Your overspending days should be over.
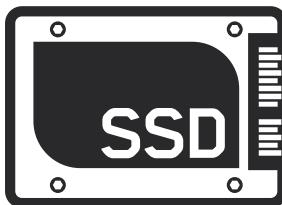
Best Speed Increase:
Solid State Drive
Solid State Drives (SSD) continue to plummet in cost, and that makes them an attractive prospect for anyone looking to

upgrade without spending lots of money. It's not just about storage: it's also about speed. Because the thing SSDs do is eliminate the bottleneck mechanical hard drives cause on modern systems.

Although SSDs have only a limited amount of space, it's worth thinking of them not as storage devices alone, but as high-speed drives. While they might not be the best value if you're looking to expand the amount of storage you have in your system their fast read and write speeds are allow them to shift data around faster than any mechanical hard drive could hope to. This will lead to speed increases in everything from system boot time to application loading time to in-game framerates. Indeed, a lot of the slowness that you might attribute to aging or inadequate hardware could actually be being caused by the growing amount of time it takes to fetch the data from your hard drive and load it into memory.

Even a basic, low-end SSD will be several times quicker than any mechanical hard drive you compare it to, so in terms of the improvement you'll see for your money it's tough to find an upgrade that can offer better results. Best of all, it doesn't require you to install any other components. You may need to install a
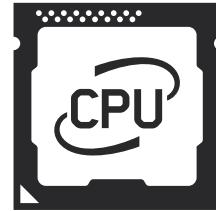
Alternative Speed Increase:
Upgrade Your CPU

If you want a faster system and you're sure that the problem isn't your storage speed – either because you own an SSD already or because the slowness is related to something like video encoding, which is a CPU-intensive activity rather than a storage-related one, then a new CPU is of course worth considering. CPU upgrades have the benefit of improving a system's responsiveness in a general sense, so the money you spend on it will definitely be good value.

drive bay converter if you don't have a 2.5" drive bay in your case, but as long as your motherboard supports SATA there's no obstacle.

500GB drives cost around £100, and 250GB drives for about £50. Either of those would be large enough to run an operating system off – though both would be best paired with a mechanical hard drive for media storage.

> 66 **Even Core i3s and low-end AMDs should become acceptable mid-level gaming machines once you install a graphics card** 99
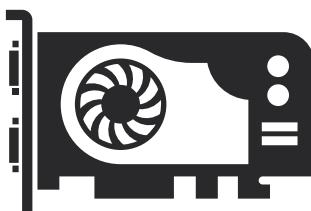
Best Gaming Improvements:
Add A Graphics Card

Assuming you don't have one in your system already, you can improve gaming performance by simply adding a graphics card. While it mostly affects the way games render, it also has a positive effect on other areas, like the way video playback performs – but don't think you need one unless you're a gamer.

Almost any system of reasonable power – even Core i3s and low-end AMD chips – should become an acceptable mid-level gaming machine once you install a graphics card. As little as £75 can buy a card that'll beat an older integrated GPU, and you don't even have to stick to recent generations of card to guarantee an improvement. That means you can take advantage of any end-of-line and open-box bargains you find.

The exact level of upgrade does depend on which type of integrated GPU you're using. On AMD chips it's easy to tell, because you just pick one better than its onboard Radeon chip. If you're running an Ivy Bridge Intel chip, virtually anything from the last generation or two of graphics card will be a vast improvement. If you're running a Haswell or Sky Lake chip the onboard GPU is slightly better, but still much weaker than most discrete cards.

Adding a graphics card isn't even a very difficult procedure at this end of the market. If you're installing a very powerful card you'll have to think about things like system temperature, power drain and interior air flow, but most sub-£150 cards should run fine as long as you have a mid-range PSU. Basically, as long as you've got a free PCI slot and a power supply stronger than about 350W, you won't even need to look at the rest of your system to check the power levels are okay.

The only down side to this upgrade is that graphics cards are quite expensive, even if they do offer a large performance increase. They are good value, but they're not cheap value – and if you're not a gamer at all, the improvements are negligible, at best!

If your PC runs on a recent Intel platform, then there's a chance you've got plenty of room to upgrade it without having to replace your motherboard as well. Even if you're running a low-end Celeron, there's room to upgrade it to the same-generation Core i7 at the very least – if not one from the platform that was released after.

If you have an AMD system upgrading the CPU is, in many ways, an easier process than upgrading an Intel system. That's because they only have two major socket types, which are compatible with a larger number of chips.

The older FX-series chips are slowly disappearing from the market, but you can still fit one in any Socket AM3+ motherboards, so if you've got an existing FX-series chip you can upgrade quite far without having to buy any other new hardware. It's not a bad upgrade, but it is worth pointing out that for the same price as a high-end FX chip you could probably buy a new motherboard and an Intel chip of comparable performance, which would give you a better upgrade path in the future.

Fusion APUs are slightly more fragmented than the FX series chips, with both FM2 and FM2+ chips available to buy. The good news is that they have built-in Radeon GPUs,

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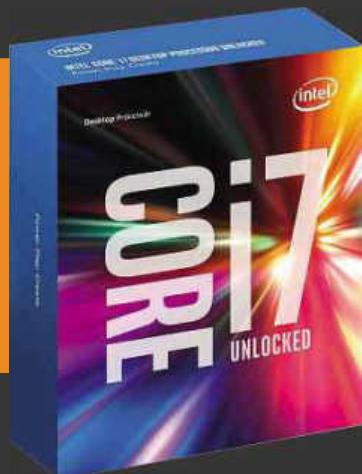
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which you can even run in crossfire mode if you've got a standalone card from a similar enough model line, which means you're not stuck with a GPU you can't use. On this level, Intel can't compete at all.

Whatever processor you have, the good value of CPU improvements is limited slightly by the fact that there's only so far you can go with an existing upgrade path before you hit a brick wall. You can't upgrade a Core i7 without swapping out the motherboard as well, for example, and the price of previous-generation CPUs doesn't come down a lot with time. If you need an immediate improvement it's worth doing, but it's a worse prospect long-term than an SSD upgrade.
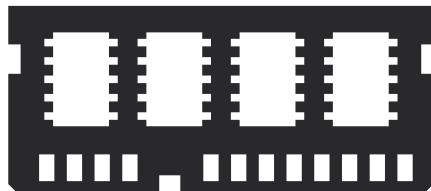
Best Application Improvements:
Add Extra RAM
Additional RAM can be a simple way to upgrade any system, but it does heavily depend on how much you have already. Extra RAM most obviously helps with things like multi-tasking and tabbed browsing, and can help applications launch quicker because it involves less use of the system's swap file – but it's also one of the

areas where you can spend a lot of money and see virtually no effect.

Generally speaking, if you're running a 64-bit version of Windows you should have 4GB of RAM as the absolute minimum for a functional system. 8GB is the minimum amount you need to run your operating system comfortably, so if you have less than that you probably will see a small improvement in your system if you add more.

Beyond that point, there's a strong likelihood that adding more RAM won't have much effect, and the chance you'll see a visible improvement becomes smaller and smaller the more you add. 16GB is still currently more RAM than any non-specialist system realisitically needs. Anything above that level will only be beneficial to systems that depend on particularly heavy RAM usage – we're talking media editing and 3D rendering systems, rather than any general purpose uses.

Be particularly careful if you're adding RAM to improve gaming speeds, because there are only certain situations in which it makes a difference. Even the most recent games don't use more than a few gigabytes of RAM unless you really crank up the settings.

> ❝ **16GB is still currently more RAM than any non-specialist system needs** ❞

That said, games do rely more heavily on graphics memory than system memory, and if you're running an integrated GPU, your graphics RAM is the same thing as your system RAM. For that reason, low amount of available system RAM can cause slowness in games that you can fix.

We appreciate that it can be tempting to chuck in a tonne of RAM because it's priced quite low and easy to install – but don't let this fool you into thinking it's definitely worth doing – not all RAM upgrades are as good value as others!
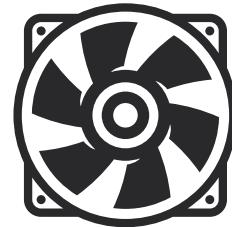
Alternative Speed Increase:
Upgrade Your Cooling
You probably know that an improved CPU cooler can allow you to overclock your chip and squeeze more power out of existing hardware. However, the same is also true of other forms of cooling in your system.
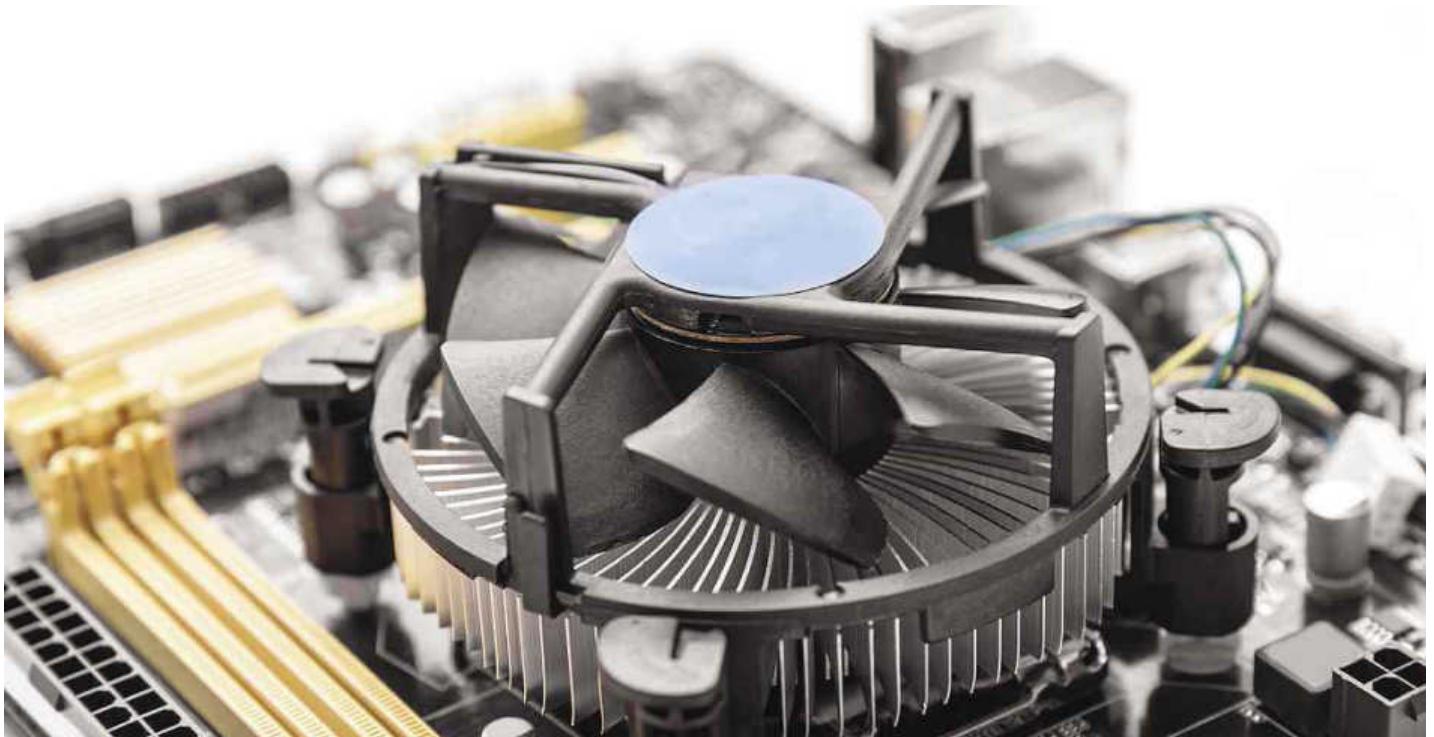
Graphics cards, for example, can be fitted with custom coolers that can allow you to overclock them without fear of causing damage. This might mean fitting a secondary (or tertiary) fan, an additional heatsink or a water-cooling unit. Unlike CPU fans, additional cooling of this manner can be tricky to install and should not be attempted unless you have full confidence in your abilities. Remember that most high-end graphics cards already have multiple cooling systems, so it may not be possible to add more!

Another alternative might be adding extra cooling features to your case. A lower ambient temperature in your case will let graphics cards, RAM and processors cool down quicker, allowing them to run faster whether they're overclocked or automatically stepped by a built-in thermometer.

The simplest way to cool your system temperate is to add exhaust fans, which aid the removal of warm air. You do have to contend with increased noise as a result, but it's a small price to pay for a faster system. More complicated cooling methods might involve creating air ducts by drilling strategically placed holes in your case, but that's a trick for those who like to get their hands properly dirty.

If you're of a less powertool-happy disposition, you can achieve similar cooling effects by rearranging your internal components to eliminate warm air pockets and cables that may impede air flow, or (even more simply) by making sure components, their heat and their fans are kept dust-free. You'd be surprised how much heat a layer of fluff can keep in!
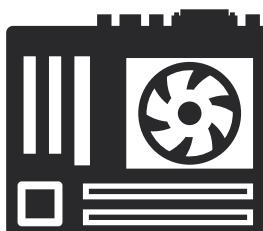
Best Long-Term Upgrade:
Replace your Motherboard

Improving your system through a motherboard upgrade isn't impossible, but its real benefits lie in the features (and potential for future upgrades) it will add, rather than immediate performance increases. In most cases, model and manufacturer don't matter so much as the motherboard's chipset, which determines the capabilities and compatibility of a motherboard.

For example, if you have (or are buying) an Intel processor, make sure you get a Z-series board because they support full overclocking of both the RAM and CPU and allow multi-GPU configurations, whereas other motherboards omit some or all of this support. Chipsets beginning with Q or B are Intel's 'Business' line and should not be used in a home PC (you'd be paying for enterprise features you don't need) while those beginning with H are the 'home' boards – stripped down versions of the Z ones with slightly fewer features.

If you're buying an AMD-compatible motherboard, you should look for boards compatible with their GPU-integrated FM2+ chips. Unlike Intel motherboards, you also need to pay close attention to the model's chipset suffix. The boards that end with the FX suffix support up to quad-card CrossFire, while the more basic X boards support just two cards.

As well as support for a faster CPU, chances are you'll likely find a motherboard refresh will bring with it more USB 3.0, USB Type-C, and SATA 6GB/s ports than you previously enjoyed, which helps future-proof your machine. It's easy to forget that sometimes systems are slow because the underlying architecture of the board doesn't give them a choice!

Of course, motherboard upgrades are often the worst value imaginable because changing the board often requires you to buy a new CPU (and more recently, RAM) as well. However, if your system is getting on a bit, trying to upgrade your system without changing the motherboard will also prove a false economy so it might be worth spending money now so you can take advantage later.

If your current motherboard is more than about four years old, it's worth spending the money to upgrade all the barebones components rather than try and stick to your current motherboard – you'll only end up spending excessive money on old components when the same cash could go a lot further (in performance terms) on new hardware! **mm**

GUIDE TO CHOOSING AN CPU & MOTHERBOARD

If you're after a market-leading chip and board, this is this is the way to go…

Picking a CPU and motherboard combination is one of the most frustrating parts of building a new system, but it has to be done early on so you can build the rest of your system around it. If you're starting with an Intel system, this is the guide for you.

Why Intel?

Before you decide what chip and motherboard you buy, you should decide whether you even want to buy one of Intel's processors. Intel CPUs tend to be more expensive than AMD's, but right now they're still significantly better when it comes to the performance they offer. Their integrated graphics aren't quite as strong, but if you're pairing the chip with a separate GPU, that makes virtually no difference. Certainly, gamers shouldn't be looking at anything else.

Intel also has significantly more options when it comes to choosing motherboards. There's more than double the number of Intel motherboards on the market than AMD ones, and while they might be quite similar to one another, you get the added benefit of being able to choose specific manufacturers or prices according to your preference.

Finally, Intel's upgrade paths are more well-defined than AMD's. It's likely the next generation of Intel CPUs (both Kaby Lake and Cannonlake) will use the same socket as Skylake's chips, whereas AMD's will be based on an entirely new architecture that requires a new socket, so any AMD hardware you buy now will be effectively at the end of the update path. That isn't necessarily unusual, but it's not the case with this generation of Intel chips.

Intel's CPUs

The two main consumer CPU lines Intel currently sells at retail are called Haswell and Skylake, with the latter being the newer of the two. The main practical distinction between them is that Haswell uses Socket LGA 1150, and Skylake uses Socket LGA 1151, which is important when it comes to choosing a motherboard.

Haswell chips were released in 2013 and 2014, and they use a 22nm microarchitecture, whereas Skylake chips were first released in 2015 and use a more efficient 14nm microarchitecture. Despite this, the chips are relatively similar in price. A 3.7GHz Core i3 chip costs around £95 regardless of which platform you choose, even though the Skylake chips are around 10-15% faster in benchmarks.

If you're thinking about on-board GPUs, again Skylake's are considerably better than Haswell's. Most of the Haswell CPUs run the older Intel HD Graphics 4000 platform for graphical performance equivalent to some aging cards like the GeForce 8600 GT or Radeon HD 3670. Skylake chips run the new Iris GPU platform, which is significantly better – the equal of a GeForce GTX 465 or Radeon R7 360.

Both lines of chips are divided into several different models. From the worst-performing to the best, you'll find:
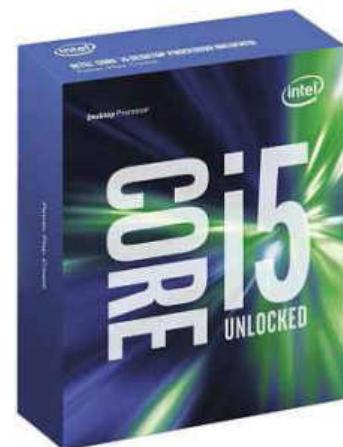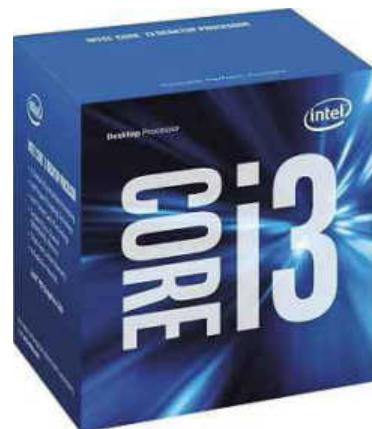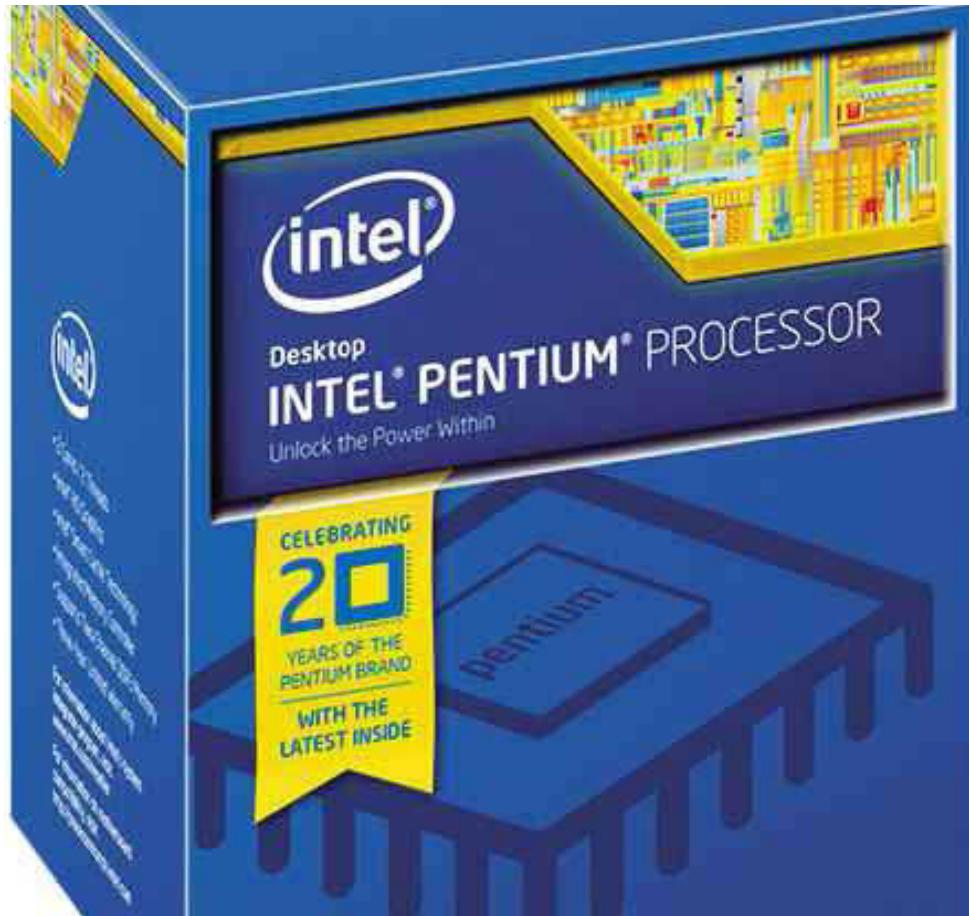
Celeron

A dual-core, reduced-cache version of the platform. Celerons don't have Hyper-Threading and are best purchased for simple-use systems rather than home or gaming PCs.

Pentium

Slightly more expensive, the main difference between Pentiums and Celerons is that they have more L3 cache. Although there's some overlap, Pentiums generally have a higher clock speed than Celerons and are perhaps aimed at basic office systems and light, non-multimedia home setups.

Core i3

Where the previous two chips are broadly aimed at business and specialised use, the core chips are Intel's consumer desktop CPUs. We'd recommend that anyone looking to build a multi-purpose desktop buy a Core i3 at the absolute minimum. Although still dual-core, Core i3s support Hyper-Threading, giving them an effective four cores, so they're good for light gaming and multi-tasking. They also have better on-board graphics than Pentiums and Celerons, but would need to be paired with a graphics card to see any real gaming performance.

Core i5

Aimed at high-end consumers, the core i5 chips tend to be the best value of the Core lines, even though they're quite expensive. Core i5 CPUs have four physical cores (without Hyper-Threading),

> **66 Aimed at high-end consumers, the core i5 chips tend to be the best value 99**

so they're better at multitasking and multithreading than the Core i3, and they combine that with faster clock speeds. Unless you're an enthusiast or building a special-use system, we highly recommend shopping within the Core i5 line for home desktops.

Core i7

With 4 physical cores and Hyper-Threading up to 8 simultaneous threads, the Core i7 line is aimed at performance enthusiasts and those building systems for specialist purposes, such as 3D animation or video rendering. Performance in normal gaming and applications won't be much better than the fastest Core i5 chips, and certainly won't be proportional to the extra cost. The TDP is also around 30% higher than Core i5 chips, if that matters to you!

K-series

Intel core chips have historically been quite good at running overclocked, which is a good way to trade off some of a CPU's lifespan for extra speed. When paired with the appropriate motherboard (of which more later), any chip with the K suffix in their model number can be overclocked. K-series chips may cost a

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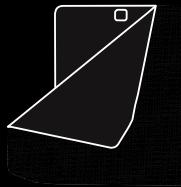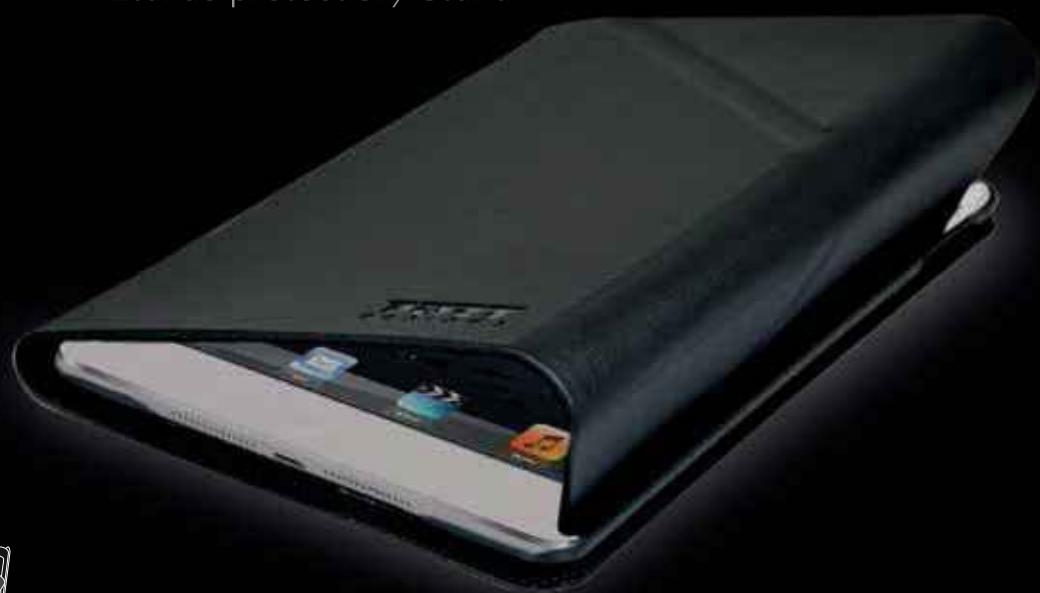
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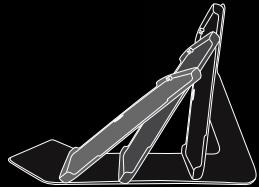
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TECHNICAL SPECIFICATIONS	
PRODUCT NAME	Muskoka iPad Air 3
REF - EAN	**201387** - 3567042013872
PRODUCT OUTSIDE SIZE	245 x 180 x 12 mm
PRODUCT WEIGHT	298 gr
PACKED OUTSIDE SIZE	270 x 185 x 18 mm
PACKED WEIGHT	344 gr
MATERIALS	Polyurethane / ABS
PCB	5
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little more than the same fixed-clock CPU, but only in the order of £5-£10, so unless you're on a tight budget, it's worth considering even if you're not planning to overclock in the short term.

Other Variants

Some chips have suffixes other than K, so just in case you want to know: A 'T' suffix means 'power optimised' (with a lower TDP, but slightly worse performance for it). An 'H' suffix means 'high performance graphics', so the GPU might be slightly better than the surrounding models. Intel doesn't divulge what a 'P' suffix means, but that tends to be the opposite of H – a slightly worse GPU than similar models. A 'Q' suffix means the chip is quad-core (if that's notable), and a 'U' suffix means it's ultra-low power.

That's not an exhaustive look at the chips available, of course – we've left out the high-end Haswell-E / Extreme Edition platform and the Xeon server platform, since most desktop users won't be interested in those. But if you're building a normal desktop PC, you should have all the information you need to pick the right CPU for you.

Intel's Motherboards

Intel's motherboard lines over the last few generations have come in six different chipsets. The letter prefix indicates the board's

> ## " Intel also has significantly more options when it comes to choosing motherboards "

purpose, and the number following indicates the position in the line. Q and B-prefixed chipsets are mostly aimed at business use, while H and Z boards are aimed at consumers.

The Intel 100-series chipset is designed for use with Skylake CPUs. They were first released in Q3 2015 and, crucially, aren't backwards-compatible with earlier Intel chips, thanks to their revised socket LGA1151. They've dropped PCI support completely, and while they're capable of supporting DDR4 RAM, some boards still use DDR3, so make sure to check. Unless you can't afford to buy new RAM and have DDR3 you can reuse, we recommend moving to DDR4 as soon as possible.

As ever, there are six main chipsets in the series, all of which are grouped together under the 'Sunrise Point' codename.

H110 is the budget consumer chipset, with fewer PCIe lanes than the others – just six, all of which are PCIe 2.0. It has four SATA 6Gbps ports, no SATAe or PCIe M.2 support, up to four USB 3.0 ports and up to ten USB 2.0 ports. Previous H-series boards had a limited number of DIMM slots, no overclocking support, no SLI graphics support and no extra features like Intel Smart Response SSD caching, so expect a similar stripped-down approach here. Its previous generation equivalents are the Haswell H81.

B150 motherboards are out now and break with Intel tradition in being aimed at gamers as well as business users. The B150 has eight PCIe 3.0 slots, six SATA 6Gbps ports, up to six USB 3.0 ports, up to 12 USB 2.0 ports and no PCIe m.2 support. They're largely aimed at budget users and again don't support overclocking or

SLI. The previous equivalents are (loosely) the Haswell B85 and the Ivy Bridge B75.

Q150 motherboards are aimed at business users, and they're due for release later this year. They'll be similar to B150 boards but support two more PCIe lanes, two more USB 3.0 ports and two more USB 2.0 ports. Its Haswell equivalent is the Q85, and the Ivy Bridge equivalent was the Q75.

H170 boards are out now and aimed at mainstream PCs, replacing the Haswell H87, Devil's Canyon H97, and Ivy Bridge H77. They support 16 PCIe lanes, allowing for SLI mode graphics, six SATA 6Gbps ports, up to two SATAe ports, eight USB 3.0 ports, 14 USB 2.0 ports, and two PCIe m.2 ports. Anyone building a standard home PC based on Skylake should start by looking at this line – the price is around £70-£100, making it quite reasonable.

Z170 boards are out now and aimed at gamers and enthusiasts. The business-focused version, the Q170, will follow later this year with similar specs. These boards have 20 PCIe 3.0 lanes, six SATA 6Gbps ports, up to three SATAe ports, up to ten USB 3.0 ports, and up to 14 USB 2.0 ports. They also support up to three PCIe M.2 devices. The Z170 succeeds the Devil's Canyon Z97, Haswell Z87 and Ivy Bridge Z77, with a complete set of features and full overclocking support. The Q170 doesn't support overclocking but has extra enterprise features. If you want a high-end system for business or pleasure, these are the boards to look out for.

Recommended Combinations

In this final section, we'll show you a selection of motherboard and CPU combinations, which we've paired up to meet various needs and prices. If you're not sure where to start, these example systems should give you an idea.

BUDGET CHOICE (Approx. £110)
Asus H81-PLUS and Intel Pentium G3258

Basically the cheapest ATX motherboard we could find with an Intel chipset was the Asus H81-PLUS, a Socket 1150 (Haswell) board available for around £55. It only has two DIMM slots, so if you're planning to reuse memory, that could be a problem in terms of getting enough in the system, but that's a very small problem. The lack of an HDMI-out port (it supports VGA only) is likely to be a bigger concern if you're trying to build a modern system but, on the other hand, if you're trying to avoid a monitor upgrade, it might be helpful to have the old connector available.

> **If you're building a high-end system, you need to pair it with a motherboard that can match it**

Although it's low-end, it has support for PCIe, USB 3.0 and SATA 6Gbps, so most of the latest technologies are accounted for even at this low level. It also has on-board gigabit LAN.

CPU-wise, this seems ideally suited to a Celeron or Pentium chip, mainly because there's very little chance of it being used for multimedia. Although it's not the fastest, we'd recommend the Intel Pentium G3258, which is a 3.2GHz dual-core Pentium costing around £55. Aside from some anniversary branding, it's identical to the Pentium G3250, though, so if you can find that cheaper, go for it!

ALL-PURPOSE CHOICE (Approx. £180)
Gigabyte GA-H170-HD3 and Intel Core i3-6100
For an all-purpose home system, you want something that'll happily accommodate a Skylake Core i3 chip, and probably the best choice that gets you all the features you want without getting expensive is the Gigabyte GA-H170-HD3. This £80 board has everything you'll need for a competitive system, with four DIMM slots, a trio of PCIe slots and space for SATA, SATA express and M.2 storage. There are also eight USB 3.0 ports and support for HDMI-out, so there's plenty of room to build a relatively high-end system around this.

In that sense, you don't have to go for a cheaper CPU (this'll take anything up to the fastest Core i7), but the lack of any overclocking functionality of multi-card graphics support means it's best treated as the basis for a less powerful system. We

recommend pairing it with a Core i3 – specifically, the Core i3-6100, which is clocked at 3.7GHz and costs just under £100. It's a good £20 to £30 cheaper than other Core i3s, even though it's virtually identical. It has 1MB less cache and just a 200MHz slower clock speed than the best Core i3, so it's hardly a poor performer.

The only possible problem with this combo is that it runs on DDR3 RAM instead of DDR4, but that's hardly a deal-breaker at this point, especially if you have DDR3 you can reuse. In a general use system, the older RAM isn't going to be any kind of bottleneck.

HIGH-END CHOICE (Approx. £305)
Gigabyte GA-Z170-HD3P and Intel Core i5-6600K
If you're building a high-end system, you need to pair it with a motherboard that can match it, and that's why we're looking at the Gigabyte GA-Z170-HD3P. Its Z170 chipset means it supports unlocked CPUs, and it's a DDR4 board so you can take advantage of the latest in RAM speeds. Support for multiple graphics cards means there's virtually no height the board cannot scale if you're building a gaming system, and it supports the latest technologies like USB 3.1 and USB Type-C, which aren't found on cheaper boards.

Priced at £102, it's still well within the price range of a typical home system, and only hardcore gaming enthusiasts need worry about spending any more than that. We'd pair it with a Core i5-6600K, which is a £200 3.5GHz quad-core, but incredible value – especially if you ever want to overclock it. If you definitely won't overclock, you can save £12 by getting the multiplier-locked version, but frankly that's a waste of potential.

Price aside, we can't see anything bad about this setup. It's modern, powerful and it'll last a long time. You'll even be able to upgrade the CPU for a newer version further down the line without having to swap out the motherboard, and as far as we're concerned, that longevity justifies the price. **mm**

GUIDE TO CHOOSING AN AMD CPU & MOTHERBOARD

It's still trailing behind Intel, but AMD has plenty to offer anyway…

Picking a CPU and motherboard combination is one of the most frustrating parts of building a new system, but it has to be done early on so you can build the rest of your system around it. If you're starting with an AMD system, here's all the information you need to choose.

Why AMD?

AMD's high-end performance has been far below Intel's for years, but when it comes to budget and general use hardware, it's still more than good enough to build a system on. Hardcore gamers and specialists will probably want to avoid AMD's chips, but if you're trying to build a system on a budget or want to get decent graphical power without buying a GPU, AMD can still fit the bill.

That's because even Intel's latest graphics technology, the Iris Pro (which appears in Skylake chips), isn't quite a match for AMD's on-board GPUs. But if you're buying a Skylake chip, then it's likely that price isn't your primary concern, and high-end chips need high-end graphics cards to get the best performance out of them anyway.

It's also worth noting that the right combination of AMD GPU and graphics card can allow you to run two GPUs in tandem, which is something you can only do on an Intel system by buying two graphics cards. If you put a separate GPU alongside a Skylake or Haswell chip, the on-board on gets ignored. With AMD, it can be used to provide extra support, improving the performance you get for your money.

Ultimately, price is probably the biggest factor in why you might want to choose AMD systems. Especially as AMD gears up for the release of its new Zen line, retailers will be preparing to get rid of AMD stock, so you should be able to pick up some reasonable bargains if you shop around. AMD chips are lower priced overall, and that forms a lot of their appeal at the lower end of the market.

AMD chips also overclock at lower prices than Intel's, so if you're a proud overclocker and want to get the satisfaction of paying less for a chip you can push harder, that might be another reason to consider Intel's rivals!

> 66 **If you're trying to build a system on a budget or want to get decent graphical power without buying a GPU, AMD can still fit the bill** 99

AMD's CPUs

AMD's CPU lines operate on different principles to Intel's, with an architecture that makes them hard to compare directly. They have more cores and clock speeds that are in a different order to Intel's. Even the best AMD chips only run as fast as slow to mid-

range Core i5s in a majority of benchmarks, no matter what the numbers might imply.
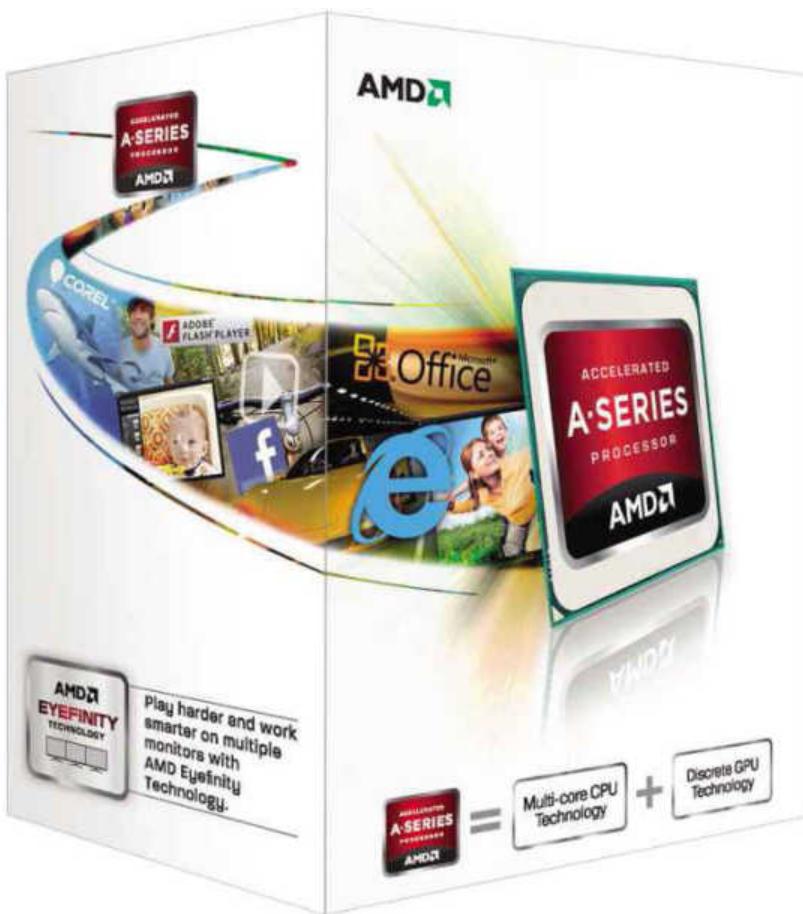
But so you can recognise them, here are the available AMD lines:

Kaveri

AMD has effectively ceased production of its stand-alone FX chips for the time being, leaving its combination CPU and GPU platform, the APU, as the only real option for CPU buyers. Kaveri APUs were released in 2014 and use 28nm Steamroller architecture. On the mobile platforms, they've effectively been replaced on the slate by their successor, Carrizo, but are still popular on the desktop. Indeed, the latest chip refresh (code-named Godavari) came out in 2015, so they're still relatively up to date. They use FM2+ motherboards and can be recognised by their 7000-series model numbers (e.g. A8-7650K).

Despite rumours that Carrizo would be coming to the desktop at some point this year, it now seems likely that AMD will be holding out until Zen is ready at the end of 2016. That means there are good opportunities to buy the latest generation APUs in the short term. They're cheap and competitive on power for any system that doesn't have a stand-alone GPU as well.

Zen

AMD has delayed the release of Zen CPUs until the end of this year, and the Skylake-rivalling APUs won't even be out until the

> **❝ Socket AM4 is a unified design that'll support both CPUs and APUs ❞**

start of next year. If you're trying to hold on for these chips, it's going to be a long wait. And despite AMD's claims, we don't even know if they'll be competitive with Intel's latest platforms as promised.

What we *do* know is that they'll have a new socket – AM4 – and use a 14nm process. The architecture will be radically different from current AMD chips and more similar to Intel's designs, which should, in theory, put them in the same league as their competitors. It's essentially a ground-up redesign.

The good news is that if you do wait for Zen to be released, Socket AM4 is a unified design that'll support both CPUs and APUs. The bad news is that if you don't want a graphics card in your system, you'll have to wait, because the initial line of FX chips won't have on-board graphics. Zen will also be the first AMD platform to support DDR4, so there are plenty of good reasons to wait to try it. But it's tough to recommend you wait for it when there's so long to go and still a lot of uncertainty about it!

AMD's Motherboards

With the FX line essentially on hold and Zen still most of a year away, AMD's motherboard line is relatively simple to understand. If you're buying a Kaveri APU (and you should be), then you'll need a Socket FM2+ motherboard.

The current generation of Kaveri chips (including the Godavari refresh) use Socket FM2+, which also accepts older Trinity and Richland chips. That means if you already have an APU (and it isn't a first-generation llano), you can upgrade the motherboard without having to upgrade the CPU at the same time. A definite win if you want to spread the cost.

Either way, if you're buying a new AMD motherboard, you're probably buying an FM2+ board. It will be the end of the line as far as upgrade paths go (Zen uses a different socket), but then you'll still get a couple of years of support and performance out of the platform, which isn't bad considering its low cost.

There are four main lines for AMD's A-series chipsets, all of which can support Godavari features (though some may require a BIOS update to enable the newest capabilities).

The A58 motherboards are entry-level FM2+ boards, recommended for use with A4 and A6 APUs. They support dual-graphics (meaning an APU and compatible graphics card). Technically, the A58 has been replaced by the A68H, meaning A58 boards are very cheap. They're commonly cut down, with two DIMM slots, one PCIe 3.0 slot, one PCIe 2.0 slot, and USB 2.0/SATA 3Gbps. Solidly last-generation stuff. They may suit budget system builders and those putting together compact systems, but at this point they're largely to be avoided outside of a specialist context.

A68H boards are a safer bet, aimed at home users with moderate needs. They're also designed to be paired with A4 and A6 APUs, with the same dual-graphics capability as the A58, but they also have native support for four SATA 6Gbps ports and two USB 3.0 ports.

A78 motherboards support PCIe 3.0, have a native six SATA 6Gbps ports and four USB 3.0 ports. They're designed to operate with A8 and A6 APUs, and even support limited levels of overclocking, making them a good choice for casual gamers.

A88X boards are at the top of the heap, though. They support full CrossFire multi-GPU systems and full overclocking of the A10 and A8 chips they're designed to pair with. They also support advanced storage, like RAID, and have four USB 3.0 ports, ten USB 2.0 ports and six SATA 3Gbps ports.

Recommended Combinations

In this final section, we'll show you a selection of motherboard and CPU combinations, which we've paired up to meet various needs and prices. If you're not sure where to start, these example systems should give you an idea.

> **❝ With the FX line essentially on hold and Zen still most of a year away, AMD's motherboard line is relatively simple to understand ❞**

Budget Choice (Approx. £90)
Asrock FM2A78 Pro4+ and AMD A-Series A4 4000

AMD's latest motherboards are still compatible with Trinity APUs from some years ago, and that makes the A4-4000 a convincing budget chip at just £25. That price is well below what you can expect to pay for an Intel processor, so it's highly attractive for bargain system builders if nothing else. That's not to say it doesn't have actual benefits, though: the on-board Radeon HD 7480G is particularly well powered, especially compared to Intel GPUs at this price.

For motherboards, it's hard to find any ATX boards that match that level of cheapness, because AMD's selection is much smaller than Intel's, but we quite liked the look of the £65 ASRock FM2A78 Pro4+. It's a Socket FM2+ motherboard with four RAM slots, HDMI-out, dual-graphics support and plenty of PCIe slots.

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> **If price is more important to you than performance, this could run a convincing light-use desktop system, which is more than you can say for Intel's low-end**

If you compare this to the equivalent Intel budget board, it's obvious you get a lot more in the way of features, even though it's a significant amount cheaper. Shop around for boards and you can maybe save even more money. If price is more important to you than performance, this could run a convincing light-use desktop system, which is more than you can say for Intel's low-end. It's not without its flaws (the chip is pretty old at this point), but at the very least it's usable.

All-Purpose Choice (Approx. £110)
Gigabyte GA-F2A88X-D3HP and A6-6420K
AMD's mid-range clocks in a lot lower than Intel's, thanks to the reduced CPU prices, and our pick for a comfortably decent home system is a Gigabyte GA-F2A88X-D3HP board (£70) and an AMD APU A6-6420K.

As a Richland chip, it's faster and more efficient than the cheaper Trinity models, and has better on-board graphics in the form of a Radeon HD 8470D GPU. It still won't win any awards for power, but it'll give better gaming performance than an Intel chip at this price, assuming no separate graphics card. As the K-suffix on the model number implies, it's also unlocked, so you'll be able to push it even harder if you're not cautious about that sort of thing!

The motherboard also has the advantage of being the best AMD can offer, based on an A88X chipset. It's overflowing with features, including gigabit Ethernet, USB 3.0 ports, PCIe support, full multicard graphics support (if you're into that) and more

besides. It even has a USB type-C port and a USB 3.1 port, which are only found in the latest Intel platforms.

Again, as a bundle it's only main failing is that the chip is slightly older than we'd ideally like to see, but the motherboard is as up to date as they come, and the FM2+ socket means it's primed for an upgrade at some point. But as with all AMD bundles, it's mainly getting by on its good value. If you can't afford Intel hardware and want a stripped-down system, this has a lot going for it, but in absolute terms, it's nowhere near a match for Intel's mid-range systems.

High-End Choice (Approx. £200)
Asus A88X-PRO and AMD A10 7800
Although no AMD system is going to match the capabilities of an Intel one, you can still put together a set of hardware that'll give you a passable gaming PC when paired with a decent graphics card. At this end of the spectrum, the low budget of AMD systems is less helpful, because it's no use saving money on a performance system. But that doesn't mean it's completely pointless, especially if you want a fast but uncomplicated PC.

For £100, this Kaveri A10 7800 CPU gives you an R7 graphics GPU with visual performance far beyond what any Intel chip can provide on its own. It might not be the best choice for gaming, but it's passable, and that saves you £100-£200 on a separate graphics card. Where it really helps is if you're building some kind of HTPC or similarly specialised system, because then you can get smooth HD video performance without the high price of Intel hardware or a separate graphics card.

The Asus A88X-Pro motherboard also costs around £100. Although it's essentially the same as the cheaper board we put in our all-purpose build, there are extra features in this one such as eSATA support and USB charging ports. Its multi-GPU capabilities include three-way CrossFireX technology, but it's debatable whether that's of much use given that it's a primarily gaming-focused feature aimed at a tiny subset of enthusiasts. But at least you've got the option, we suppose!

It isn't going to be the best system you can build for £200, because you can get an Intel board and a Core i5 for around that much, but if you decide to go for an AMD system, this is a combination we can recommend. **mm**

WHAT **COMPONENTS** CAN YOU **RE-USE**?

Don't cripple a system upgrade with false economies

Buying a new PC off-the-shelf might be simple, but it can be annoying to pay for components you don't use. If someone else builds your PC for you, you also risk voiding your warranty by opening it up to install your existing gear. What's more, if you want to transfer that expensive SSD or Blu-ray drive into a new computer you'll have to build it from scratch yourself.

If you're doing that anyway, there's no reason not to re-use as much as you can, and recycling hardware has lots of benefits. It saves money, it reduces waste, and it means you're familiar with your PC's components if you encounter a problem you've solved before.

Not every piece of hardware should be recycled, however. So here's our rough guide to what you should and shouldn't keep.

CPU

If you're upgrading your main system, it's likely because it's no longer fast enough. If that's the case, hanging onto your old CPU isn't a good idea. That's not to say that it's impossible – if your new motherboard socket is compatible with your old chip you could absolutely put it in a new PC – but if that's the case then it may be worth saving longer to get an upgrade to a newer, more powerful platform.

If you DO transfer your old CPU over, take great care when removing and reinserting it, and be especially vigilant about cooling. You'll need to wipe clean and reapply thermal paste to your chip and cooler to ensure heat is dispersed efficiency.

RAM

Although memory is cheap, it's definitely worth transferring into a new system provided you've got room for it on your new motherboard. If you buy new RAM as well, make sure the older modules are placed in the second set of slots so the newer stuff is used first, but other than that having extra memory available can only be a good thing.

The shift to DDR4 does means that the time is coming when DDR3 modules can no longer be transferred over from an old system to a new one, so you might find your new motherboard doesn't actually support them – but if it does, the only reason to drop RAM (assuming it's error-free) is when you haven't got space for it.

Motherboard

Although motherboards themselves are broadly re-usable, the main limiting factor is the CPU socket. Shelling out for a new system seems

redundant if the motherboard still prevents you from upgrading the processor much!

If you do re-use an old motherboard in a new system, be aware that you might also miss out on the latest versions of common connections, like HDMI 2.1 and USB Type-C. This may not be a deal breaker, but it could limit the functionality of a system as they become more popular.

If you decide to re-use a motherboard, it's probably only worth doing if you're repurposing an old system, rather than upgrading it. At least in this case you have the benefit of being able to easily hang onto the old CPU and RAM as well!

PSU

Having a working PSU to hand can save a huge chunk of money on a new system build, since the average decent one costs around £40-£80. Wait a moment, though: PSUs are notoriously vulnerable to aging. Not only do they clog with dust, their components also lose efficiency from the extreme stresses they face.

Most PSUs have a safe lifespan of around five years, and should be replaced once they pass that point (take that advice from someone who's seen an old PSU burst into

flames before). It's alsp worth noting that, even if your PSU seems fine, plugging a new system into an older component might be enough to push it over the edge. The increased drain of (for example) a more powerful graphics card might be too much stress for an already-failing unit, and the resulting surge as it dies could damage your new components.
If your PSU is getting old, we can strongly recommend spending the money on a replacement alongside your new hardware – if only for the peace of mind.

" Plugging a new system into an older PSU might be enough to push it over the edge "

HDD / SSD
Storage is some of the most easily reused hardware, and can be useful as primary drive (if you want to save money) or secondary drive (if you want to increase overall storage). If you're using the old hardware as your primary drive, it's worth wiping

it and starting with a completely fresh Windows installation if only to prevent the OS being confused about what system it's been installed on (it uses the motherboard serial code for authentication, so if that changes it won't be happy).
Whether it's used for primary storage or backup, make sure you check the disk thoroughly for errors before you make it permanent. If the hardware has already been in use a long time, it could be vulnerable to bad sectors, or (in the case of mechanical drives) a crash, which would result in data loss.
Generally, though, there's little risk to re-using storage of any kind unless it's particularly old. At worst, all you stand to lose is data, and proper backups can make the risk of that negligible in itself.

Optical Drives
Do computers still need optical drives? It's hard to say. Certainly, manufacturers think laptops don't, but if you've got one in an old PC and you think you might use it, there's no good reason not to put it in. The power drain, effect on boot times and contribution to a PC's internal temperature are all negligible. Failure is both incredibly rare and completely harmless when it does happen. If you want to buy

an external optical drive or you don't think you'll need your current one, that's fair enough – but if you've got them going spare, they might as well go in there if there's room!

Cases
The case is the one part of a PC that can persist almost indefinitely if you treat it right. Again, take it from someone who used the same basic case for almost 17 years. As long as your case fits an ATX motherboard (and most do) you can hang onto it forever, basically.
Reasons to upgrade might include a desire for more advanced features, like tool-free fittings and 2.5mm enclosures, but it's even possible to add these features yourself for less money than a new case would end up costing you. Perhaps the only definite reason to upgrade is if your case is insufficiently ventilated for new, hotter-running components you might have bought – but even that can be fixed with a drill!
We know it's sometimes nice to have a new case, especially if you're looking to save space with a smaller one – but short of actual damage there's almost nothing that'll necessitate one. The only down side is that basic specifiaction cases are so cheap that you save almost no money by re-using one! **mm**

MAKING AN
EMERGENCY LINUX
INSTALLATION

Having a Linux disto you can turn to in a pinch could be a lifesaver

When you're putting together a PC, things aren't always straightforward. If something goes wrong – a hardware compatibility issue, a corrupted drive, a misconfiguration – then you might suddenly find yourself without any way to research the very problem you want to fix.

If that happens, it's always worth having a bootable USB drive to help you bypass whatever the problem might be and get back online so you can figure out what's going on. If you want to do that, you'll have to make one in advance, though. If you don't have a Windows USB stick available (and especially if your PC doesn't have an optical drive) then there's no better time than the present to get that sorted out.

What You Need
Before you start, you need to get a USB stick. Most Linux installations will fit in around 2GB, and it shouldn't be hard to find one of that size lying around. If you need to buy one, we recommend you don't go too large otherwise you'll find that space is wasted. It literally costs a couple of pounds for a 2GB drive from most outlets!

You should also choose a version of Linux to install. We think Ubuntu Desktop is a good choice, but the same basic instructions should work for most versions as long as you're downloading the same type of disc image (an .iso file). You can get Ubuntu Desktop from **www.ubuntu.com/download**, and like most Linux versions it's completely free if you want it to be.

Make sure you download the correct version for your system, though. If you've got a PC with less than 2GB RAM, get the 32-bit version. But if you're hoping to use it in a new PC the 64-bit version is the one you most likely need.

Although there are many ways to transfer Linux disc images onto a USB drive, the easiest way within Windows is to use the Universal USB Installer, which you can download from the 'Pen Drive Linux' site at **tinyurl.com/y6elvmw**

Preparing The USB Drive
To use the Universal USB tool, you need to be running Windows XP or later, and the drive needs to be formatted using any version of a standard Windows file system – FAT16, FAT32 or NTFS. If you're not sure

what file format the drive uses and/or wish to reformat the drive, plug it into your PC, locate it in Windows Explorer then right click on the drive and select 'Format' from the context menu.

Leave the file system on its default setting (FAT) and the allocation unit size of 2048 bytes. You can choose a volume label here if you like (it's best to choose something helpful like 'linux_boot').

Finally, deselect 'Quick format' and then hit 'Start'. This will reformat the drive into the selected file system and erase the entire contents of the drive, so make sure you don't have anything important on there!

Installing Linux
Run the universal download installer. You'll be presented with a choice of Linux distributions. If you've been following our instructions you'll have downloaded the Ubuntu Desktop 64-bit edition so select 'Ubuntu' from the list.

Now click 'browse' and locate the place where you downloaded the Ubuntu .iso file. If the file was in an archive (for example a RAR or ZIP) you may have to extract it first, and if the file was not in

Making A Bootable Linux Drive On A Mac

If you don't have access to a Windows PC, but you do have a Mac at hand, you can't use the instructions in the rest of this article. However, you can still make a bootable USB drive. It's a lot more complicated, but it can be done.

First, open the Terminal. The quickest way to do this is to simply type 'terminal' in spotlight. Next, browse to the place where you downloaded the Linux .iso file to. You must convert it into an .img file using Hdiutil, so type the following command:

hdiutil convert -format UDRW -o target.img ubuntu.iso

Now get a list of all attached devices by typing:

diskutil list

Then connect up your USB drive and type the command again. Look for the new drive that has appeared in the list and make a note of its path (it'll be something like **/dev/disk2**). Now run the following command to prepare the USB drive for writing:

diskutil unmountDisk /dev/disk*X* [Where *X* is the number the USB drive is assigned – repeat this in all future commands]. Now type:

sudo dd if=ubuntu.img of=/dev/rdisk*X* bs=1m

Which transfers the image to the USB drive. Then type:

diskutil eject /dev/disk*X*

You can then eject the USB key safely. The resulting USB drive will be bootable on both a Windows and Mac system!

.iso format you may need to convert it into that format.

Finally, select the drive from the list. There is an option to erase the contents of that drive in this tool, but shouldn't be necessary if you've been following our instructions. The drop down will only show removable drives, so double-check that you're choosing the right drive letter from the disk – this is why it helps to have chosen a useful volume name when you formatted it.

If you have additional space on your drive, you can optionally use the "set a persistent file size for storing changes" option to create an editable area so you can download new Linux software to the USB stick. If you don't do this, your downloads will be discarded and your changes forgotten when you reboot, but if you're not planning to make this your primary OS that shouldn't be a huge problem!

Finally, hit create and the process will run. At the end, you'll have a working Linux drive.

Running Linux
To run your copy of Linux, all you have to do is place your drive in the USB port when you boot your PC. Most new motherboards will check the USB ports for bootable drives before using the built-in storage, so it shouldn't require any intervention.

If the boot doesn't work, you may need to manually check your motherboard BIOS's boot order. Refer to the manual for details of how to change this!

Once installed, Ubuntu should be more or less capable of getting you online immediately. If you have wireless hardware installed you'll need to enter the Wireless Key before you can get online (click the wireless icon in the top right to see available networks). Ubuntu ships with Firefox pre-installed, so you should have little trouble making sense of how to get online and start researching whatever problem is afflicting your PC!

Remember that if you want to save your changes you'll need to have allocated space for them – so if you didn't, make a physical note of any websites or files you might need to refer to again later. With any luck, though, you'll only need to access Linux once before your problems are fixed. **mm**

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Has **Hulk Hogan** Just Changed Internet Journalism Forever?

The former wrestler turned reality star just won a court case that might have enormous consequences. Sarah Dobbs finds out more

If you tend to steer clear of celebrity news and internet gossip blogs, you might not have even thought about Hulk Hogan in a while. He's recently been at the centre of a massively controversial court case, however. One that might have far-reaching consequences for online journalism as a whole.

To briefly summarise: back in 2012, gossip blog *Gawker* received a DVD from an anonymous source. It was a half-hour long sex tape, featuring Hulk Hogan (real name Terry Bollea) with Heather Clem, the ex-wife of Hogan's friend Todd Alan Clem (aka Bubba The Love Sponge – seriously). The site decided to publish a short clip of the video, less than two minutes long, along with a blog post describing the, er, action. Bollea took action, speaking to rival gossip outlets about the tape, claiming he didn't know he was being videoed, and didn't know where the tape had come from; he also took legal action, suing Clem for making the video, trying to get it removed from the blog, and asking for an injunction to prevent *Gawker* from publishing any further clips from the tape.
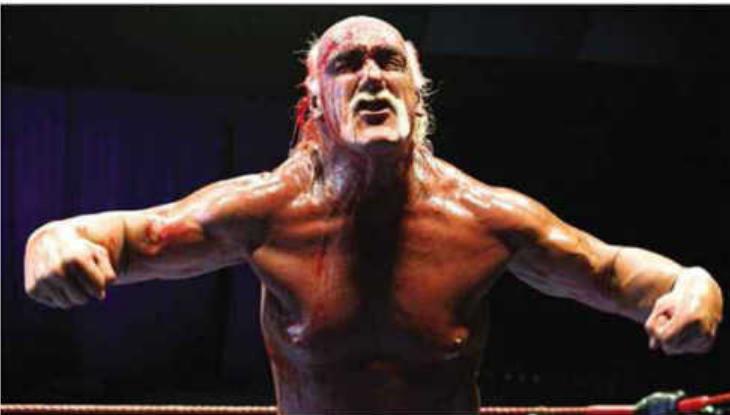
Before the most recent court case, a judge had told Gawker to remove the video, but the site refused

GAWKER

Even for a Minute, Watching Hulk Hogan Have Sex in a Canopy Bed is Not Safe For Work but Watch it Anyway

A.J. Daulerio
10/04/12 2:15pm · Filed to: NSFW

Update: The video posted here has been removed pending litigation. See here for details. If you'd like to watch it elsewhere, you may do so here.

▲ *Gawker has removed the video now, but defiantly still includes a link for the curious…*

The case bounced from court to court, until finally, last month, a verdict was reached in a Florida courtroom. The judge and jury found in favour of Hogan, and awarded him a whopping $140 million (approximately £97 million) in damages, which includes $55 million for economic damages, plus $60 million for emotional damage. The jury also found Nick Denton, *Gawker*'s founder, and AJ Dauleria, the editor who published the clip, personally liable – Denton has been asked to personally pay $10 million to Hogan, while Dauleria has been hit with a $100,000 penalty.

Serves them right? Well, maybe so. This case is about more than the rights or wrongs of airing the details of one celebrity's sordid sex life, though. It's about freedom of speech, and what is and isn't acceptable for publication online. Plus, if *Gawker* doesn't manage to successfully appeal the ruling, the amount of money involved could well see it, and the other blogs in its network (like *Gizmodo*, *Kotaku*, and *Lifehacker*) pull down their shutters. So as awkward as it is to talk about, or even contemplate, this ruling really might change the internet. Let's take a look at the arguments in the case so far, and what they might mean…

The Arguments

Boiled down to its most essential components, 'Hogan vs Gawker' pitted the star's right to privacy against the website's First Amendment rights (the one about freedom of speech and freedom of the press). Whether one trumps the other is a tricky thing to figure out, which is why this case has dragged on for so long.

On the one hand, individuals are entitled to an expectation of privacy, and Hogan has argued that the publication of this video had left him "completely humiliated". On the other hand, sites like *Gawker* are covered under the US Constitution, and are entitled to publish facts about public figures… provided that the facts aren't 'highly offensive to a reasonable person', or aren't of legitimate interest to the public.

Both of those conditions are difficult to define with any degree of certainty. It's worth noting here that 'of interest to the public' doesn't just mean that people would be interested to read about it, otherwise *Gawker*'s site analytics could settle that one right off the bat. In journalistic terms, the kinds of stories that can be defined as in the public interest usually involve exposing criminal activity or impropriety, or protecting public health and safety, or exposing something misleading that an individual or

organisation might be trying to convey. A story about a politician who was running on a platform of family values but had been caught having an affair, for example, could comfortably be described as being in the public interest.

Gawker's defence argued that, since Hulk Hogan had publicly discussed his sex life on TV and in interviews in the past, that this video was both newsworthy and not a meaningful violation of his privacy. The defendant, however, countered that 'Hulk Hogan' was a character he played on screen, while in real life, he's Terry Bollea and therefore his private affairs are separate and not a matter of public interest.

His lawyers also argued that *Gawker* wasn't bothered about the importance of the story as much as the money it could make from publishing the video. According to them, the site would've made hundreds of thousands of dollars off the page, though *Gawker*'s legal team said it had only netted them about $11,000 (approximately £7,600).

How much Gawker profited from Dauleria's decision to hit publish on the clip arguably didn't matter as much as the damage it did to Hogan's reputation – or how much the court could be persuaded that it had done. The amount awarded – more than the $100 million Bollea had even asked for in the first place – suggest something else was going on, too. This case was about setting a precedent, and striking a blow against online celebrity journalism as a whole.

Just to confirm that, after the verdict was delivered, David Houston, one of Hogan's attorneys announced: "This is not only his victory today, but anyone else who's been victimised by tabloid journalism."

The Consequences

It's interesting that Houston used the word 'tabloid', because that conjures images of newspapers rather than websites. Celebrity journalism has become a different beast thanks to the internet, however. Online news moves faster and spreads wider, as one site picks up another's story and runs with it.

While many of the bigger online celebrity news sources tend to be owned by large media corporations now, there's nothing to stop just about anyone setting up a website and posting whatever they want about whoever they want, which can make the internet feel a bit like the wild west, where anything goes. The online media landscape is less wild than it used to be, though, and this isn't the first time a celeb has brought a case against a website. It's not even the first time *Gawker* has been sued.

Having lawsuits brought against you is one of the risks of running a gossip blog (or indeed
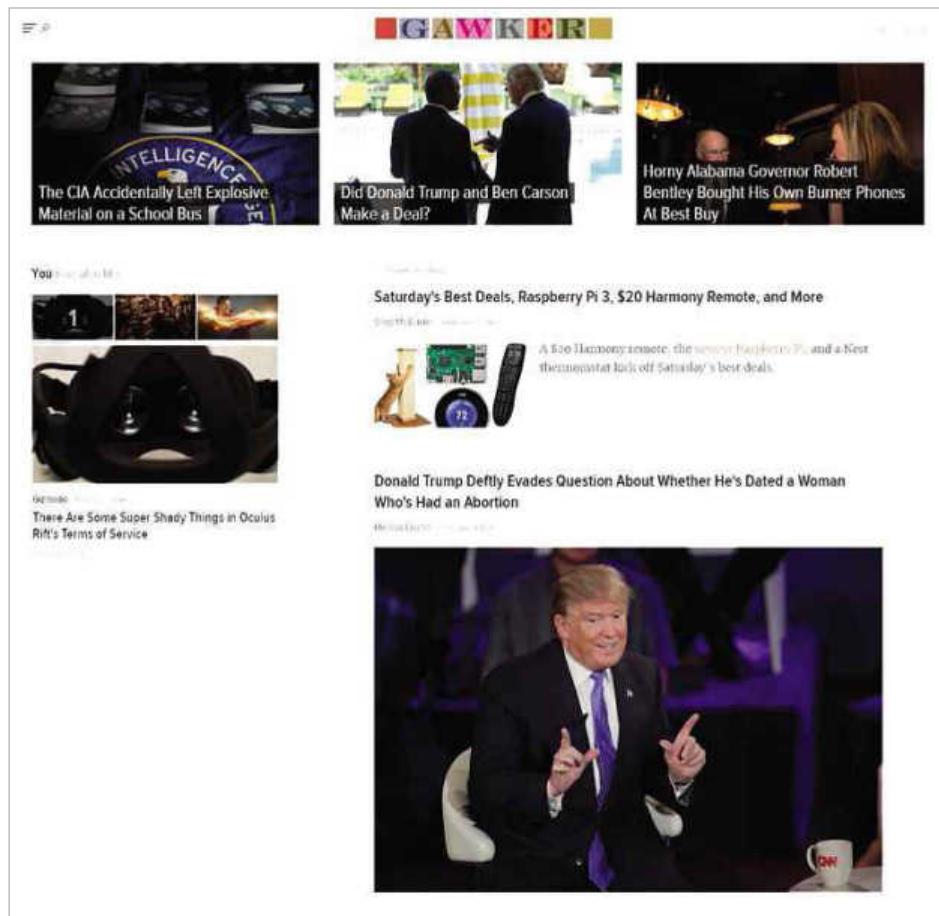
▲ *There are plenty of other, more serious stories on the site, but this one controversial story might damage Gawker irrevocably*

any kind of news outlet, if you're reporting things that people might not like to hear), but in the past, most of the suits have been settled out of court. This time could be different, though. That huge settlement sum, if *Gawker* is forced to pay it, will at best put a large dent in the company's coffers, and at worst, could wipe out the whole *Gawker* network of blogs.

Knock-on Effects

It'll also serve as a deterrent to other sites, while emboldening other public figures to take legal action against sites they feel have wronged them. That might be a frightening can of worms to have opened. In cases like the Bollea/Gawker one, you might feel that maybe the world wouldn't be much worse off without journalism like that, but... well, that's the thing about freedom of the press. Drawing the line at distasteful stories could mean that all sorts of potentially important stories might also not be published for fear of legal repercussions.

Sites smaller than *Gawker* might become unwilling to publish stories that might attract threats of legal action from powerful people or corporations, because of the prohibitive costs of fighting lawsuits. Then, whoever has the most money controls the news.

The internet represents the most democratic medium ever. Again, this seems like an incredibly trivial story to go to bat over, but maintaining freedom of the 'press' – where 'press' means blogs as well as broadsheet newspapers – is important if we want to feel informed about the world.

This case isn't over, either: *Gawker* will be appealing, hoping to get the verdict overturned or, at least, the damages reduced. In the end, the precedent that's set might turn out to be something completely different than it currently seems. it seems like people are already taking notice of the ruling,

though, like US presidential candidate Donald Trump. Among his many campaign promises, he's vowed to "open up" libel laws, to ensure that the subjects of awkward stories can take newspapers and websites to court, and win.

Whether that's something that's likely, or even possible, is debatable; even if he's elected, Trump probably can't do much about the First Amendment, but it's an interesting and scary idea anyway. Many politicians probably feel attacked by the press, but does it sound like a good plan to make sure news outlets are too scared of legal action to run damaging stories about what our elected representatives are up to?

Across The Pond

Of course, everything discussed so far has been about US law, and the laws discussed are American ones. Here in the UK, freedom of speech is covered by Article 10 of the European Convention on Human Rights, which became part of UK law thanks to the Human Rights Act 1998. It guarantees 'freedom of expression' for broadcast, print and 'speech', but does add some restrictions, including one "for the protection of the reputation and rights of others."

That basically means a similar case in the UK would mean a similar legal battle, in which the legal rights to privacy and to freedom of expression come into conflict. Terry Bollea's victory could still be seen to set a precedent for UK celebs who want to protest their media treatment – and, of course, the internet is international, so if US sites end up being effectively muzzled, that limits the news we'd have access to here, too.

It seems counter-intuitive, but maybe it'd be best to hope the appeals court decides in Gawker's favour, or at least makes the amount of money it had to pay Hogan less punishingly huge. Maybe we don't need to see intimate videos of not-terribly-relevant celebs, but at the same time, don't we need to make sure the right to publish true stories, no matter how unpleasant their subjects might find them, is protected? **mm**

What About The Rest Of Us?

Terry Bollea might be able to argue that the things he does in some parts of his life belong to a fictional character, but the rest of us generally can't say the same. Then again, most of us probably won't ever have to sue a website for publishing compromising videos of us. Then again, 'revenge porn', in which vengeful ex-partners post intimate photos or videos online, has become a grim phenomenon over the last few years.

The good news is, it's totally illegal. Under Section 33 of the Criminal Justice and Courts Act 2015, it's an offence to distribute sexual images without the consent of the people in the images, and with the intent to cause distress. It carries a penalty of up to two years in prison. And unless you're a celebrity, there's unlikely to be any kind of public interest defence, either. So that's good to know.

The Best Free Alternatives To Commercial Apps

Even if your budget is limited, there's no reason to go without essential apps with free alternatives so readily available

There's a very popular saying that says, 'There's no such thing as a free lunch'. This rather cynical expression is a shorthand way of saying nothing comes for free and that you should expect to pay something, even if you don't expect to. There's always a catch, basically.

The thing is, although this is often true, when it comes to PC software, it's not always the case. The freeware market for PC software is chock full of applications that are offered for nothing, and while you might expect these gratis options to be unable to compete with commercial software, you'd be wrong. This is far from the truth and, in actual fact, sometimes free alternatives can actually be better suited to a user than an expensive package. This isn't just down to the lack of any cost, but the features. Some freeware easily keeps up with its commercial counterparts when it comes to functionality, and some feature improved designs, being easier to use, while granting the same results.

With this in mind, we wanted to showcase a number of free alternatives to commercial packages every PC user looking to save money should check out. We're going to cover a wide range of software, so there should be something for everyone here. If you like to get something for free, read on. Please note, we're not going to cover internet browsers, as all the major ones are free anyway, and as with all selections of software, we can't cover everything, so don't be afraid to have a look for yourself; you might be able to find even programs that suit you more.

Office Suites

OpenOffice
www.openoffice.org

Definitely one of the best free alternatives to any commercial software, office suite or not, OpenOffice is a superb free package that contains everything you need, whether you're a home or business user. It features all the modules you'll find in the likes of Microsoft Office, only without the need to pay hundreds of pounds for the privilege.

It features a powerful word processor in the form of OpenOffice Writer, spreadsheet tool, presentation suite (OpenOffice's version of PowerPoint), database package, image editor and much more. Basically, almost all of the aspects of MS Office are found here, and although Microsoft's suite is still the most powerful, OpenOffice can meet the needs of almost any user, save for those who need the under-the-hood power of MS Office, which is a relatively small number, such as developers and large-scale users.

When it comes to cross-format support, OpenOffice is spot on, easily handling documents and files from other competing packages, including MS Office, so there shouldn't be any problems working with others parties who may be using other formats of documents. You can open most formats, and OpenOffice can also save documents out in other formats, such as Word .doc files.

OpenOffice is the perfect ambassador for open-source software, as it has no strings attached and is constantly being worked on, with
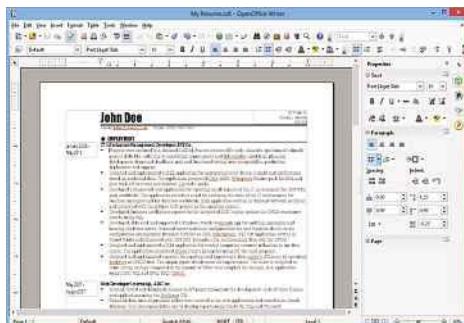
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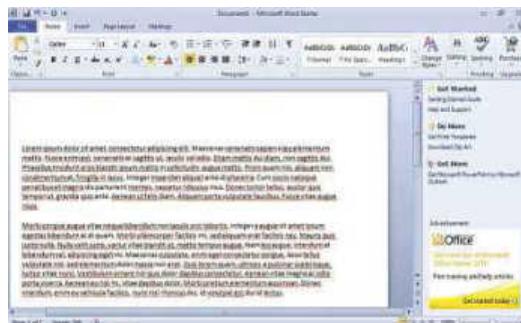
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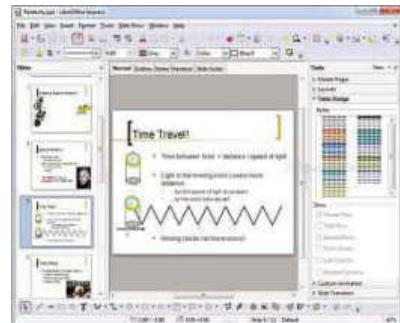
▲ *Libreoffice*
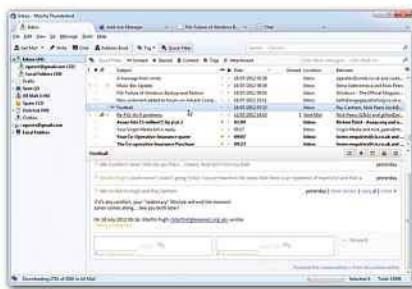
▲ *Thunderbird.*

▲ *Gimp*

▲ *Adobe Creative Suite 2*

new updates and patches bolstering the suite. It's also cross-platform, so it isn't limited to Windows. It's a truly excellent piece of software.

Microsoft Office Starter
www.microsoft.com

If you're a fully paid-up Microsoft fan but can't afford the expensive MS Office suite or any of its various versions, maybe this will appeal to you.

Microsoft Office Starter is, as the name suggests, a starter package for the popular commercial suite. Unlike the full package, this only features two applications, both of which are cut-down. There's a streamlined version of Word and PowerPoint, both with interfaces that feature ads, so there's a bit of nagging to put up with.

The features are severely limited, so the package isn't recommended for business use, but if you're a home user who simply needs basic word processing, this should be fine. You have the benefit of the instantly recognisable GUI and integration within Windows, and it's free.

If you need more power, however, you'll need to look elsewhere or simply look to the previous entry here.

LibreOffice
www.libreoffice.org

Like OpenOffice, this is a full office suite for free. It features word processing, databases, spreadsheets and a diagram tool. Each application is solid and offers all the features you'd expect. It's all accessed via a useful central menu, and the GUI is standard, so if you've used any office software, Microsoft or otherwise, you'll be at home here.

It can handle most common file types, including Microsoft variants, and can save files out in other formats too, so it's easy to collaborate with others. All in all, it may not be as powerful as MS Office or OpenOffice, but it's a very good office suite and one that's easily capable of handling most tasks for the majority of users.

Email
Thunderbird
www.mozilla.org

Although there are few commercial emails tools that make any waves, with Microsoft Office's Outlook being the most relevant, some people are looking for a good, non-browser option. If this is you, look no further than Thunderbird, arguably the best free, local email tool around.

Part of the Mozilla group of software, Thunderbird is a powerful and fully featured tool that functions just like Microsoft's Outlook in many ways, and almost identically to the classic fan-favourite, Outlook Express. It's a local email tool that can be set up to monitor multiple email accounts, downloading and storing messages and attachments locally on your PC instead of on a remote server (this can be changed, if you prefer remote storage, though) and work with personalised email addresses. Because it's a local app, the

interface is more customisable than web-based options, and it's also faster and more responsive, with more room for user-preference.

There's a useful address book, chat tool, powerful tabbed search, archiving tools and much more. If you work with a large amount of email, you'll know how problematic web-browser clients can be. Working with a local client like Thunderbird makes this task far easier.

Image Editors
Gimp
www.gimp.org

By far the most popular freeware alternative to big name editors like Photoshop, Gimp (GNU Image Manipulation Program) is an open-source editor that boasts a huge amount of power and is actually more powerful than a lot of other commercial apps. It's another open source package that's in constant development and is cross platform.

As an editor, it features all the advanced tools you'd expect to find in any decent commercial package, including full support for layers, a wide range of photo touch-up tools, transformation, programming algorithms and much more. Rest assured, this is much more than a simple image editor, and even the most advanced artist will be happy with what's on offer. If there's something missing, though, Gimp also supports extensions, so more functionality can be added, should it be needed.

Adobe Creative Suite 2
www.adobe.com

Although this is more than just an image editor, a major component of the suite is the hugely popular Photoshop. Being CS2, this suite isn't exactly current, of course, and it consists of older versions of many of Adobe's products, but even these will usually outperform most alternatives, such is the power behind Adobe's suite, especially Photoshop. There are more powerful programs available, as this is an older program now, but it's still a very good application.

So popular is Photoshop, the name has become a verb. The package is used by people of all abilities and suits almost any image editing task, from touching up images and photos, to creating works of art from scratch. Getting this for free, even an older version, is a real boon, as Photoshop commands very high prices.

We should mention that this deal wasn't initially offered as a free package, but only to those with an existing license, as Adobe deactivated the activation servers for the package and had to do this for legacy users. However, at the time of writing, Adobe made the suite and serial keys available on its own website, so you can freely download it.

Paint.net
www.getpaint.net

This is a very good image editor that offers quite a lot of power, without the complex interface and more confusing setup of the
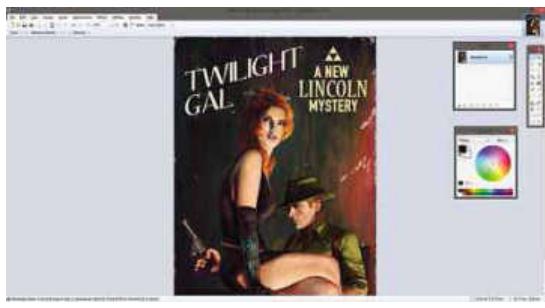
▲ *Paint.NET*

▲ *Avidemux*

▲ *Pazera Free MP4 to AVI Converter*

likes of Gimp or Photoshop. As the name implies, it's designed as a more powerful variation of the standard Windows editor, Paint. By this, we mean it's a far more advanced app that features plenty of tools for any home image editor who needs to perform everyday tasks. Advanced users can also find use for it, as it's great at doing simple tasks that other editors may be overkill for.

Like other open-source editors, it's updated regularly, so there are tweaks and refinements always being added. The interface is clean, and although it lacks the power of other editors, for most users this is the ideal editor in terms of approachability and learning curve.

Video Editors And Converters
Avidemux
avidemux.org
If you're not after a full video editor, but simply need a tool for cutting, filtering or encoding, Avidemux will be a good pick. It doesn't have the complex power of a fully fledged editor, but its simple interface handles the core functions such as trimming video very well, and it's easier to do so here than in a more complex program. Sometimes, you just need that simple touch.

The app supports a wide range of video types, and it can export to various formats too. As an encoder, it's also very useful and incorporates a bitrate calculator as well as a range of format schemes for common tasks.

Pazera Free MP4 to AVI Converter
www.pazera-software.com
Pazera Free MP4 to AVI Converter is more than the name suggests. It's a video converter than can actually handle a very wide range of conversions, more than just MP4 and AVI. It's very easy to use; all you need to do is drag and drop your videos into the program and select the conversion settings. The program will take care of the rest.

To make things easier, there's a range of presets, such as DVD, XviD, H.264 and more, and these profiles include a wide range of audio codecs and settings. It'll even work on files not specifically supported by the app, so it's worth experimenting if you need to convert a file that doesn't play on a specific device.

VirtualDub
www.virtualdub.org
One of the older freeware video packages available, VirtualDub is nonetheless still a fine option for those looking for a decent free editing package. It's an editor, video capture tool and processor all in one, and it can capture video from various sources, including webcams, digital cameras or any other device connected to your PC.

The editor is fairly flexible, although it may lack some of the more advanced features more up-to-date packages include. The tool can work with audio tracks too, and it can do this without having to alter the actual video, and there are some decent compression routines. It's a great free editor and is especially good for those just getting into editing, who need to learn without having to spend a lot of cash.

Audio Editing
Audacity
www.audacityteam.org
Yes, we had to include it, didn't we? It may be a usual suspect, but there's a reason Audacity always finds its way into the best freeware collections and that's because it's simply great. Compared to other, more accomplished editors, Audacity may seem a little simple, but under this misleading appearance is very easy to use and deceptively powerful, and it can work with all major audio types, apply effects, touch up poor recordings and more.

Cutting, copying and pasting audio is simple enough, thanks to the traditional waveform interface, and you can record audio directly into the app for editing or simply to save it out. There's a customisable spectrogram mode, audio analysis and various plug-ins. Overall, an essential free audio app.

▲ *VirtualDub*
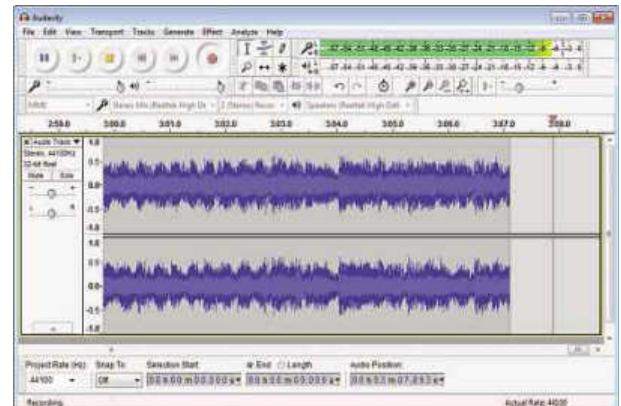
▲ *Audacity*

ADDON T3
PORTABLE WIRELESS SPEAKER

PLAY
LONGER
& LOUDER

30h
50% VOL

12h
100% VOL

4.0 Bluetooth

audio pro
SOUND OF SCANDINAVIA
www.audioprodirect.co.uk

▲ Mp3DirectCut

▲ CDBurnerXP
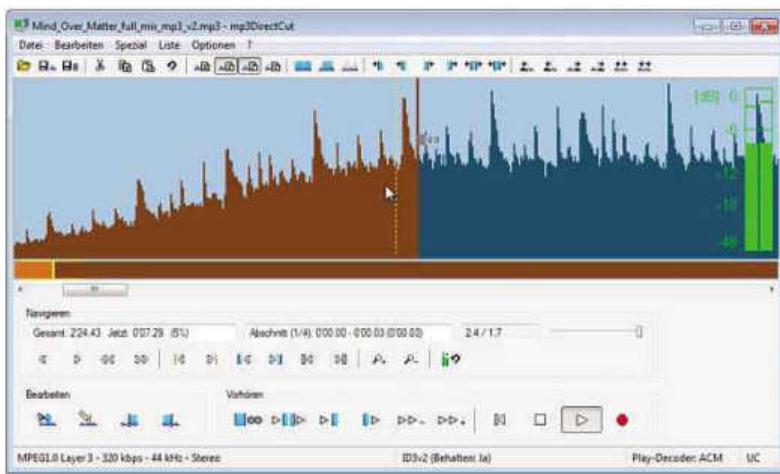
Mp3DirectCut
mpesch3.de1.cc/mp3dc.html

If you're interested in working with MP3s primarily, this app will be of interest. It's a focused tool that allows users to trim and edit MP3 files. It does this non-destructively and also allows the normalisation of audio, along with a smattering of effects.

CD/DVD Burners And Image tools

CDBurnerXP
cdburnerxp.se/en/home

If you just need a solid, straightforward disc burning tool, this should suffice. Able to burn CD, DVD and even Blu-ray and HD-DVD (in the unlikely case you have any), CDBurnerXP is a flexible tool that can also work with images, such as .iso and it can also be used to create both data and audio discs. It can rip audio discs, and features WAV normalising and MP3 encoding. Some of this is pretty standard stuff, of course, but sometimes you need a simple program that does the job well. This is one such tool, which comes with plenty of extras.

Ashampoo Burning Studio Free
www.ashampoo.com

Ashampoo's full disc burning suite has been around for some time, and it's always offered a fully featured selection of disc burning tools that easily compete with commercial apps of this type. It can work with all types of disc, including Blu-ray, and it handles all sorts of image types.

The interface is simple and easy to use, based on different tasks you can execute with the suite, and it can also convert a wide range of file formats, such as audio conversion between MP3, WAV, FLAC and WMA. You can bulk copy discs, utilise backup features and create burning projects. It's a powerful suite for a free option, and it one that comes highly recommended.
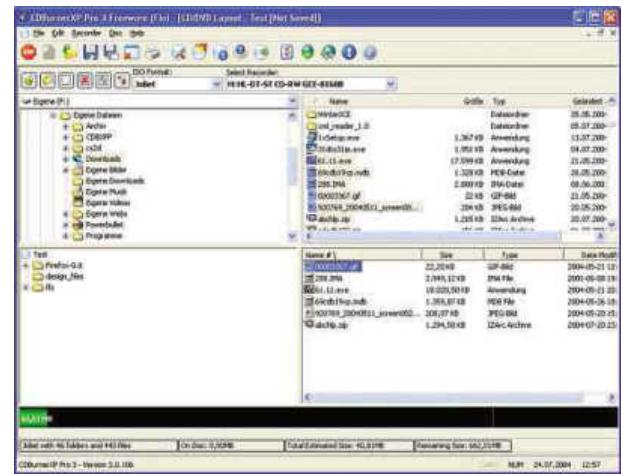
ImgBurn
www.imgburn.com

The name of this free app says it all really. This is a program all about image burning, and using it you can quickly and easily burn various types of image to disc, including a wide range of types, such as .iso, .bin, .img and more. It can work with all kinds of disc and even has features that deal with dual-layer DVDs, so you can get the most out of your media's available space.

As well as burning images, it can also be used to create images, making it a great all-round tool for working with images of data, whatever they may be, and doubling up as a decent backup tool.

BurnAware Free
www.burnaware.com

This is another disc burning suite that caters for most types of user, from simple disc burning and authoring tools to options for backups and image manipulation. Like Ashampoo and commercial tools, it's a complete studio and one that can handle most tasks. It can also work with DVD file structures, burning full DVDs complete with menus. If you need to create a bootable .iso image, this is covered too. All this is wrapped up in a simple, straightforward interface.

Daemon Tools Lite
www.daemon-tools.cc

One of the most popular free tools around when it comes to working with disc images, Daemon Tools is seen by many as the de facto image mounting application – and for good reason. It's a simple, minimalist application that can mount and run multiple disc images using virtual drives. It does this while using fewer resources than a lot of competing applications and, although you can buy a more powerful version of the program, the free package, Deamon Tools Lite, is perfect for home users.
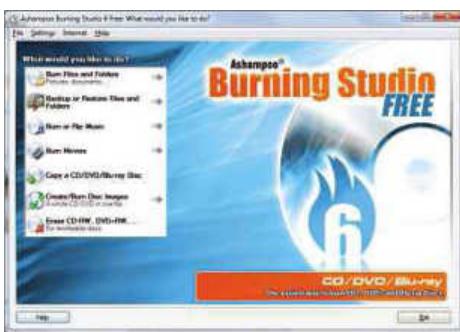
▲ Ashampoo Burning Studio Free

▲ ImgBurn

▲ BurnAware Free

▲ *Deamon Tools Lite*

▲ *Aptana*

▲ *OpenBexi*

Web Design

Aptana
www.aptana.com
This is an open source web development tool that's based on Java. It's cross-platform, supporting Windows, Linux and Mac, and it supports a range of common languages, including the likes of Ruby on Rails. As well as standard web development duties, it can also produce applications for the iPhone.

It's a powerful, tool and its support of multiple languages makes it useful for most designers looking for a decent free tool. It also opens the door for mobile app development, which can only be a good thing in this day and age. Sadly, the interface isn't exactly user-friendly, and it doesn't even include a spell check. There's also no support for RSS, Atom or Xpath. However, despite the flaws, this is still a good option.

OpenBexi
sourceforge.net/projects/ob-htmlbuilder
Open Bexi is a little different from a lot of editors. It makes use of drag and drop to create web pages, with users dropping widgets onto the project. These widgets include text, images, audio and more. It's designed to make creating web pages easier for newcomers with little programming experience, and it includes an FTP function, so uploading created content can be done with no need for extra software. Server-side scripting is also supported.

Microsoft Expression Web
www.microsoft.com
Now available as a free app, Microsoft's application is basically the company's version of the popular Dreamweaver, so it features a lot of the same tools, as well as sharing a similar design. There's full support for W3C, as well as excellent disability functions.

As this is a Microsoft tool, and one that follows a similar style to Dreamweaver, any users with a passing familiarity with either of these two company's apps will be at home here. That's good, because Microsoft doesn't actually support the program if you're a free user, and only those who bought it prior to the free release are given help. If this doesn't bother you, though, you'll find this suite to be very accomplished.

Kompozer
www.kompozer.net
Based on Mozilla, this is a powerful open-source editor that really does push towards Dreamweaver levels of power. It's a true WYSIWYG editor for Windows that can handle almost any web design task, except server-side scripting, which it doesn't support.

It features a built-in FTP, CSS editor and an HTML validation tool, and it can work easily with forms and has multiple templates. The HTML it produces supports all major browsers, so you shouldn't run into any major compatibility problems, and you shouldn't need large-scale debugging of your projects. It's not quite as fast or powerful as Dreamweaver, and it lacks some advanced options, but for a free alternative, you'll find few as good.

Antivirus

AVG
free.avg.com/au-en/homepage
Possibly the most popular free anti-virus app around, AVG is a hugely popular download that easily competes with the commercial crowd in terms of features and in some tests, also in terms of effectiveness.

Like all anti-virus apps, it has a full resident virus scanner, as well as a host of extras, such as remote protection via a mobile device, Mac and Android support, browser security for harmful links and a useful, straightforward interface. It lacks some features, which are reserved for the paid version, but the core tools included in the free download are more than enough for general use.
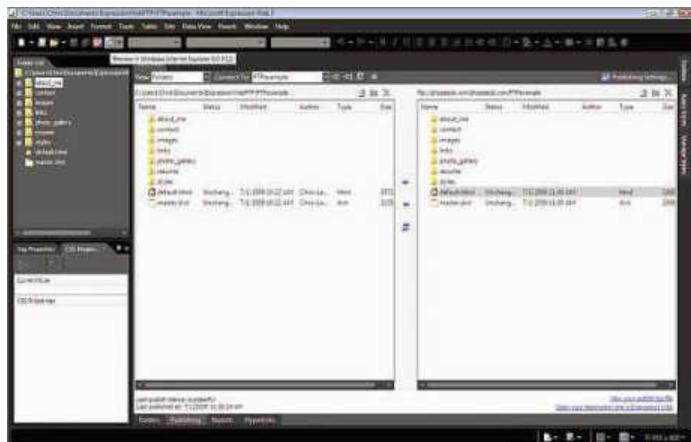
▲ *Microsoft Expression Web*

▲ *Kompozer*

▲ AVG

▲ Bitdefender

▲ Avast!

AVG is a little more resource hungry than some other scanners, though, so if you prefer a lower footprint from your security software, you may want to choose a different program.

Bitdefender
www.bitdefender.com
With a very low resource footprint, Bitdefender is a good choice for those who don't want to give over too much of their system to security. The scanner is small and can run in the background, with little to no intrusion on your daily PC use. It has a 'zero configuration' setup and is ready to go without any need to set it up, and there are no ads to nag you.

As for effectiveness, Bitdefender is one of the best free scanners around. It boasts solid performance against threats, and its resident scanner gives you a good level of protection, while updates happen automatically in the background. The developer claims its one of the best options for gaming, due to its silent nature, and that its security outperforms its rivals. Although labs tests of anti-virus software usually shows different results from test to test, it's clear that Bitdefender is always one of the better options.

Avast!
www.avast.com
Another big player in the free anti-virus market, Avast has quickly become a firm favourite with users. This is thanks to its solid protection, of course, but also its clean, straightforward interface, relatively small system footprint and constant updates that keep the app on top form.

The free version lacks a lot of the features of the paid incarnation, but it still includes a solid virus shield, browser security and a password manager. The browser extensions in particular are very useful, able to keep you safe from dodgy websites and to monitor downloaded files. However, be aware that these have been known to cause some problems with browsers. This isn't unique to Avast, though, and other security software can have the same problem, so
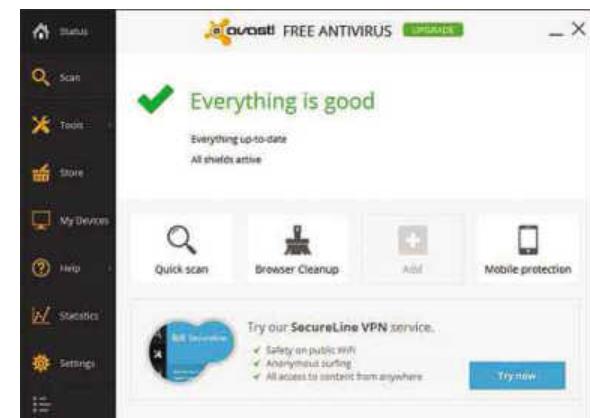
don't be put off trying Avast because of this, because you'll find it's a very good AV tool.

Firewalls
ZoneAlarm
www.zonealarm.com
There no reason beating about the bush here. ZoneAlarm is not only the longest-serving free firewall, but it's also the best in many ways. Although it's had its ups and downs and many users have moved on to other options, when it comes to lab tests on actual technical functionality, it boasts some of the best protection around, able to defeat various kinds of attack and remain operational after attempts to disable it.

It runs very quietly, with minimal pop-ups, because it can automatically retrieve program definitions from a large database in order to create rules for you, not bothering you with alerts. It even offers some basic anti-virus protection, although this isn't the reason you should pick it. Simply put, if you're looking for solid protection, you'll be happy with ZoneAlarm.

Comodo Firewall
www.comodo.com
Comodo Firewall is another great free security tool and one that some would say betters ZoneAlarm. Like ZoneAlarm, Comodo is a solid firewall that's resistant to attack and bypass attacks and it also feature anti-virus protection. It also includes a hardened browser, secure DNS lookups and boasts a sandbox tool. These features make Comodo a favourite of more technical users, but the more casual may want to stick with the more straightforward firewall apps.

TinyWall
tinywall.pados.hu
Speaking of straightforward, there's TinyWall. This is a basic, no-frills firewall that focuses on the one main task and doesn't cram in extras that get in the way. While this may sound counterproductive and

▲ ZoneAlarm

▲ Comodo Firewall
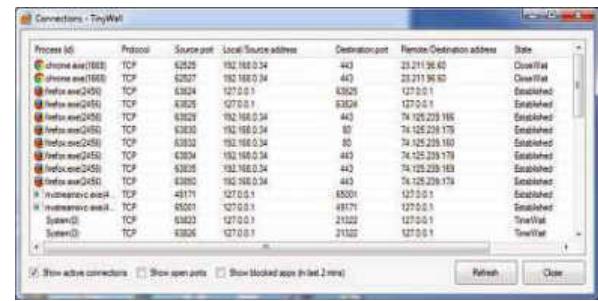
▲ TinyWall
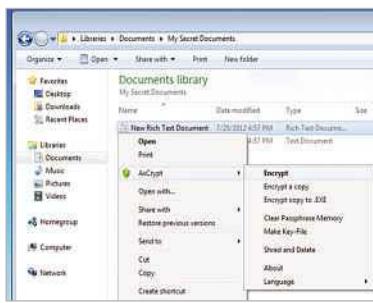
▲ AxCrypt

▲ GNU Privacy Guard

▲ BitLocker

a firewall with more features may appeal more, don't be put off. TinyWall may be simple, but it offers a great level of security that's perfect for users who just want an app to sit there and protect them with no fuss.

It does this by working alongside the Windows firewall, and although simple, the protection works and is perfect for non-technical users.

Encryption Tools

AxCrypt
www.axantum.com

This open-source encryption tool is one of the most useful options for users who value their privacy. Although it's not able to encrypt whole volumes, it's a great file encryption tool that's integrated within the Windows shell.

From the Windows context menu you can quickly encrypt any file with its 128-bit AES encryption. As well as simple encryption, files can be encrypted for a set period, after which time they'll automatically decrypt, and you can work with files that will decrypt while in use and encrypt when not. It's a very flexible and fast system, with encryption taking little time, and the whole program is less than 1MB in size.

The 128-bit encryption isn't as strong as some, though, so in this regard, the protection isn't as solid, but it's still secure for most users, and the Windows shell integration makes it very easy to use.

GNU Privacy Guard
www.gnupg.org

This is actually based on PGP (Pretty Good Privacy) and is an open source version of the popular encryption platform. Therefore, it offers a very high level of security with powerful encryption that supports various types of encryption methods and ciphers, and it can protect anything from a single file, all the way up to an entire volume – local or external media.

PGP is very popular for a reason, and that's because it's a very strong form of encryption software, and this open-source variant of it is one of the best free options around.

BitLocker
www.microsoft.com

Although this isn't technically freeware, as it comes as part of Windows (7 Ultimate and Enterprise, 8 Pro and Enterprise and Windows Server 2008 upward), it's still already present on your system if you have one of these operating systems, and it's also prized by many users for being strong and dependable, not to mention easy to use.

It can encrypt an entire volume with ease, and features both 128 and 256-bit AES encryption. Additionally, it can encrypt drives into a virtual state, which can be opened and worked with, while retaining the security. Various authentications are supported, including passwords, PINs and USB keys.

The software has come under fire from conspiracy theorist in the past, who claim the software has a backdoor put there by Microsoft for third parties, such as government agencies, to access. Microsoft has denied this, of course, but there's really no solid proof either way, so this fact may colour your opinion of the tool.

7-Zip
www.7-zip.org

Yes, 7-Zip is a file archive and compression tool, but did you know it also features a very useful encryption function? It does, and because there's a good chance you already have 7-Zip on your PC, you can make use of it right away.

Within the application lies a simple encryption tool that can lock down your archived data with 256-bit AES encryption. It can handle files, folders or even volumes. As it's 7-Zip, encrypted files are very portable ,and this makes it a great tool for those who need to send sensitive data to others. It's even free for commercial use. This makes 7-Zip a surprisingly good and recommended encryption tool.

Backup

EaseUS Todo Backup Free
www.todo-backup.com

EaseUS ToDo Backup has become one of the most popular free tools for securing data, and it includes all the features you'd expect
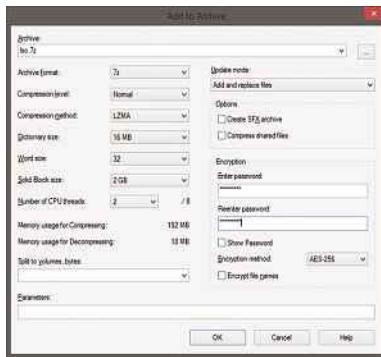
▲ 7-Zip

▲ EaseUS Todo Backup Free

▲ AOMEI Backupper Standard

▲ *PDFedit*

▲ *CutePDF Writer*
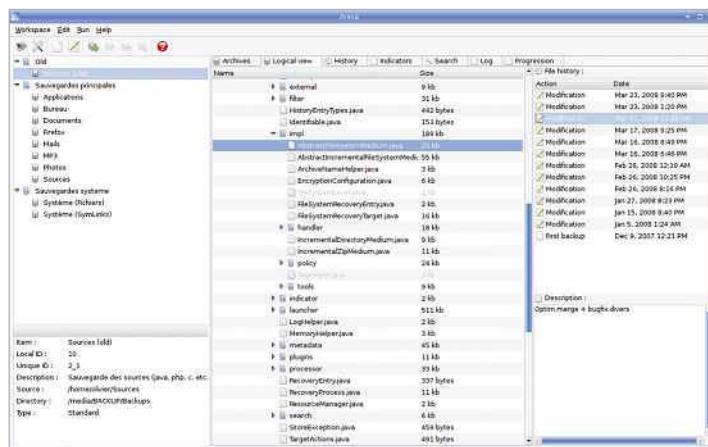
to find in a typical program of this type, even commercial ones. The usual things are included, such as scheduled backups, disc image creation, disk cloning and more. Alongside this, the app features goods extras, such as a smart backup that can automatically check folders for new data to back up, and it can save data to cloud services like Dropbox or Google Drive.

The level of power on offer here is impressive, almost rivalling paid-for apps. Tasks like incremental backups, network throttling, bootup recovery and a built-in rescue environment all add to the appeal, and although it's a little more complex than some, it can be as simple or complex as you like.

AOMEI Backupper Standard
www.backup-utility.com

If it's simplicity and ease of use you're after, AOMEI Backupper is for you. This tool's striking interface is not only attractive, but it also keeps the program well ordered and straightforward. Everything on offer here is delivered with simplicity in mind, and there are no complex menus or settings to worry about.

What you get here is a solid backup solution that features manual and scheduled backups, disk cloning, image creation and a rescue disc feature. Even new PC users will find the program easy to operate, and although it may lack advanced features, it's perfectly suitable for casual home use.

Areca Backup
www.areca-backup.org

Areca Backup is a more advanced tool that's designed to cater for a more technical user. Alongside all of the standard backup features, Areca offers archive file support, powerful file filters, network backup, FTP functionality and even encryption. This is all crammed into an admittedly fiddly interface that isn't kind to less technically proficient users, but the extra toys should please advanced users.

Of particular note has to be the backup tech the app uses, which can monitor files and back up only the modified content. This grants a far speedier backup system and one that uses far fewer system resources.

PDF tools
CutePDF Writer
www.cutepdf.com

Although it can't actually edit PDF files as such, CutePDF Writer is still one of the most popular free PDF tools available as it can create PDFs from most file types, thus giving users an easy and free way to utilise the popular fixed document type.
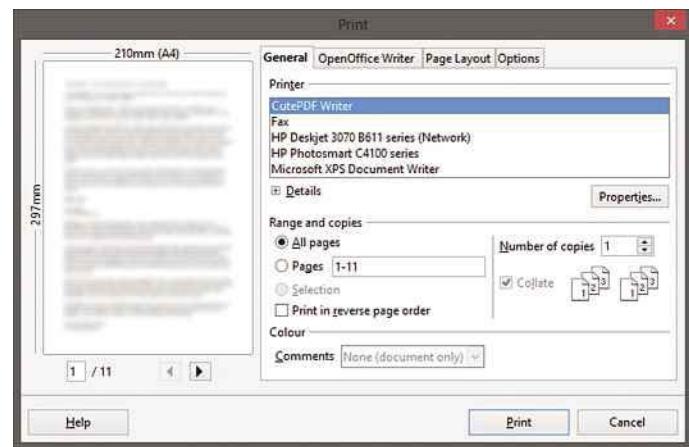
It does this by functioning as a virtual printer, which 'prints' out PDF files from whatever you enter into it. CutePDF appears as a printer within Windows and applications, and by selecting it as your printer, you can create PDF files by outputting to a specified location. It's simple and easy to use, and the PDFs it creates are spot on.

PDFedit
pdfedit.cz/en/index.html

Most of the free PDF 'editors' you see online are not actually that. Instead, many of these allow users to annotate PDF files. The actual content of the document can't be changed. There are web-based services that offer this option, but if you want to do it yourself, you'll really need to spend hundreds of pounds on Adobe's full Acrobat program (not to be confused with the free Acrobat Reader, which can also annotate PDFs). However, there is an interesting option in the form of PDFedit.

This is a work-in-progress, open-source tool which now has a beta version for Windows (it was previously Unix-based). It can actually open and edit a PDF file. It's still early days, so it's buggy and not exactly inviting at this stage, but as a program that can save you a lot of money, it's well worth keeping an eye on. **mm**

▲ *PDFedit*
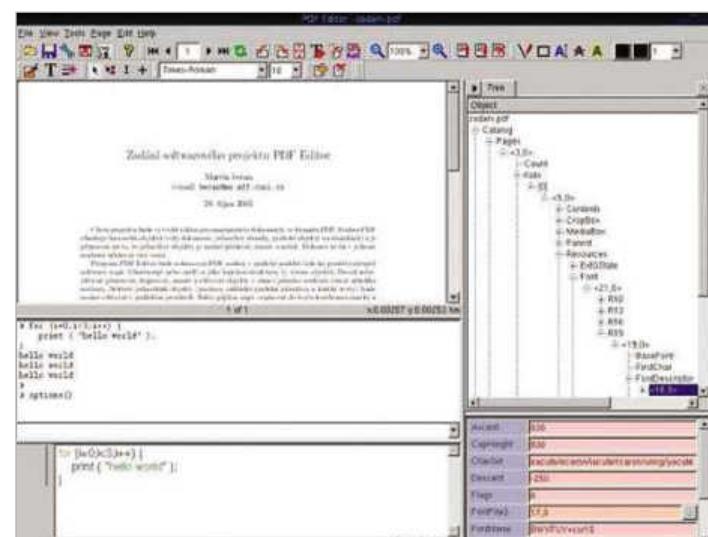
How To Recover Lost Files And Data

Everyone loses files at some point. Roland Waddilove shows how to prevent this and how to recover them when disaster strikes

Disk drives are supposed to keep our files safe and sound, and mostly they do. Sometimes they keep them safe for five or more years, and in some cases there have been disk drives that have lasted ten years or more without developing a fault. It is unwise to rely on them, though. Indeed, there's an old saying that goes, 'Hope for the best, but plan for the worst'. That's true with disk drives: although you can hope that they'll provide many years of reliable operation, you should treat them like they'll fail tomorrow. Could you cope?

At some point in time, you'll find you need to recover lost data and missing files, repair corrupted files, and perhaps even recover a whole disk drive that has suddenly died for no apparent reason at all. One day you might switch on your computer, the disk drive clicks and that that's it. Dead! Could you cope with a failure like that? It could be a massive disaster, or it could be a minor inconvenience, depending on your circumstances and how well prepared you are for data loss. In this article, we'll look at a variety of techniques for recovering from minor problems like a lost file to major faults like a completely dead drive.

> ❝ **Recovering data, files, folders and whole disks is immeasurably easier if you're prepared for disaster, but sadly many people aren't** ❞

Sometimes files go missing, and what happens to them is a complete mystery. You know you downloaded a file last week and it should be in the Downloads folder, but now it isn't there. It's a similar story with documents saved from word processors and other applications. You know you saved a file and swear you put it in a particular folder, but now it's not there. It's like someone moves them or deletes them when we're not around. It's spooky, and it happens more often than many people realise.

Even if files are not lost, they can still become corrupted, and there are a number of reasons for this. One is that there was some sort of computer or software glitch just as the data – such as a photo, video or document – was being written to disk. Some bits or bytes are altered and the saved data is then corrupt. This might then prevent the file from being opened in the future. Bugs in applications can also cause files to be incorrectly saved to disk, and they might have bad data, corrupt information and so on.

File corruption and data loss is not always caused by a hardware or software error, though; sometimes we make mistakes ourselves. We might delete files or folders we later discover that we need. This can happen when we create a new version of a file and save it, either overwriting or deleting the original, before realising we need the previous version after all. For example, we might edit an original photo and make changes to it, instead of creating a copy and modifying that.

We might power off a PC because it has locked up and refuses to respond to the keyboard or mouse. We might pull the plug of a USB disk drive or pull out a USB flash memory drive before files have finished being saved to it. The storage in digital cameras might become corrupt if you take a photo just as the battery is dying and it's partially saved to the storage media and so on.

Recovering data, files, folders and whole disks is immeasurably easier if you're prepared for disaster, but sadly many people aren't. They lose a file, and only then do they look around for some way to recover it. The problem is that downloading and installing software onto the drive that has the lost data can destroy the data you want to recover by overwriting it.

You should be prepared for all types of data loss scenario. You need to have the tools and applications in place now, while your PC is running perfectly and has no problems, rather than after one has occurred. If you're lucky, you might be able to recover what you lost, using some of the tools here. However, data recovery works best if you're prepared. Get the tools now.

Essential Hardware And Software

File loss, corruption and even completely dead disk drives are much less of a problem when you have a backup. They're not the complete solution, because you can still lose files due to the time interval between backups. The more frequently a backup is performed, the more files are protected. It's easy to see how you might lose a file with a weekly backup schedule. Files you created yesterday or the day before can still be lost because they are not yet in the backup.

You should at least back up on a daily basis and then at least you can go to yesterday's files if you've lost some. You'll lose any changes made today on them, and you could lose files

⌃ *A USB drive like this Western Digital Elements Desktop is an essential accessory*
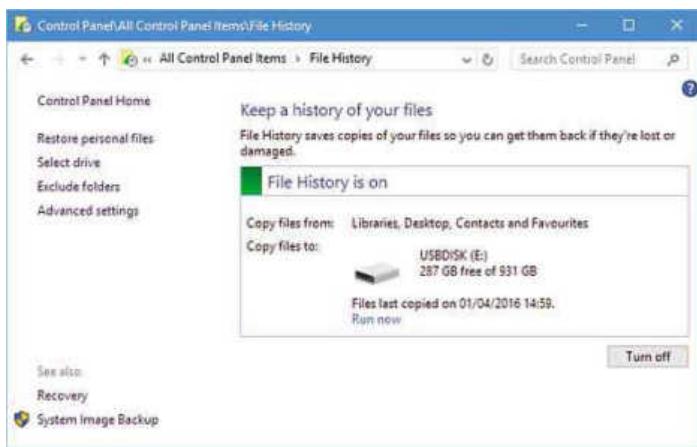
▲ *Turn on File History in the Control Panel of Windows 8.1 and 10*
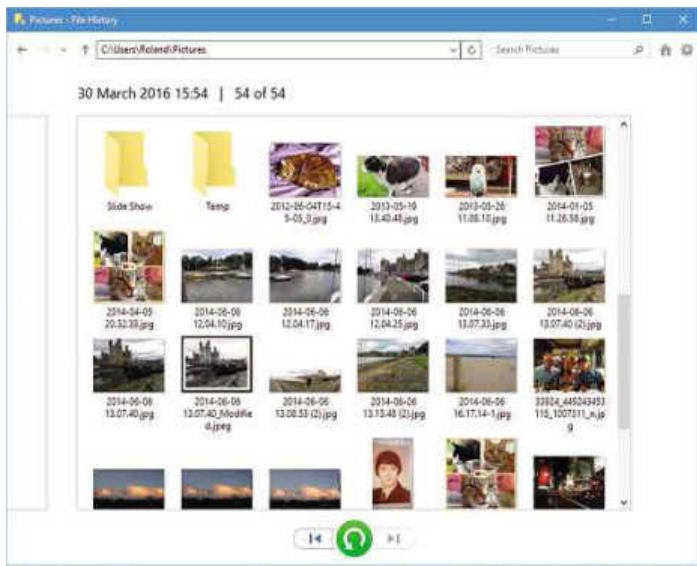
▲ *File History lets you browse backups by date and time, and recover lost files*

this afternoon that you created this morning, but it's better than weekly backups, where there's no record at all of recently created files.

The best protection is provided by hourly backups. It might seem like an arduous and unnecessary task backing up every hour, but with intelligent backup software it's not necessarily so. The number of files that change every hour is often very small, so a backup job can run in the background and finish in a minute or so without interrupting what you're doing. Okay, you might want to pause backups when playing fast action games and you need lightning fast reflexes and an equally responsive computer, but apart from this, backups are not noticeable.

Two disk drives are required for backups, and an external USB disk drive is the easiest way to add storage to your PC. There are lots of USB drives to choose from. Capacities are increasing, while price are shrinking, and it's possible to pick up a 1TB disk for about £40 and 2TB drives for roughly £60. If you don't have onem then buy one as soon as you can.

Recover Data With File History

If you're running Windows 8.1 or 10, there's a backup utility in the Control Panel called File History. It's so simple that anyone can use it, and you won't notice it running. It just gets on with

the job in the background without you having to do a thing. Just plug in a USB drive, open File History and click Select drive on the left. Choose the USB, drive and turn on File History if it doesn't automatically turn on. You can now forget it.

Whenever the USB disk is plugged in, File History backs up your files. If it isn't plugged in or powered up, File History waits until it's back online. Open File History in the Control Panel and click Advanced Settings. It saves copies of files every hour by default, but other backup schedules are available (it can back up every ten minutes if you really want to). It saves multiple versions of files, and there's an option to choose the length of time old versions of files are kept. Choose 'Until space is needed', and File History will delete old copies of files as and when disk space is required for backing up new files.

It's important to be aware that File History backs up only your personal folder (C:\Users\YourName). However, this includes Documents, Music, Pictures, Videos, OneDrive, Contacts, Desktop and so on. Other files elsewhere on the disk are not backed up.

If you lose a file or want to return to a previous version of a file, open File History and click the link on the left, 'Restore personal files'. A window opens, and the left and right arrow buttons enable you to browse the files and folders, while the date and time at the top show when they were saved. This means you can go back to 3pm a week last Thursday, for example, and look at files and folders as they were at that time. Select a file or folder, then the big green button restores it.

Free Backup And Recovery

File History is great for backing up files in your personal folder so you can recover them if they're lost or corrupted, but you might have files elsewhere on the disk. There's also the problem of total disk failure. It's essential that you make a complete system image of the drive and store it on an external USB drive. If you have a big enough USB drive, such as 2TB or more, you can run both File History and a backup utility that images the disk drive.

The recovery tool with backup software enables you to put the disk back as it was. It also enables you to browse the contents of the image and pick out single files and restore them. It's simply a snapshot of a disk at a particular time, and it's great for recovering lost or corrupted files.

▲ *Paragon's backup software enables you to back up and restore disks and files*
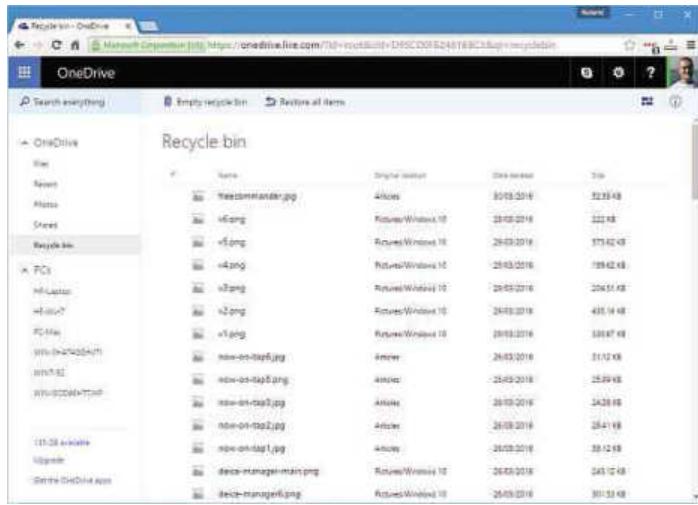
▲ *Online storage like OneDrive has its own recycle bin. Your lost files might be in there*

▲ *Online drives often store previous versions of files. Recover them in a browser*

Paragon Software has two free utilities, Backup & Recovery 14 Free Edition and Rescue Kit 14 Free Edition. They both have a backup/restore utility that can copy the whole disk sector by sector for an exact image. The backup can be saved anywhere, and a USB disk drive is best, but if you have a big disk in your PC that has lots of space, you can save backups to a hidden partition. If disaster strikes, you can restore

66 The best protection is provided by hourly backups 99

everything or browse the backup for a single file. It avoids the expense of a USB disk, but ideally the backup should be on a separate drive.

The Rescue Kit, which runs from the boot media, includes data recovery tools that help to get your computer working again, like the Boot Corrector Wizard. It searches for Windows partitions, corrects drive letters, fixes master boot records, repairs boot configuration data, sets the active partition, hides or shows partitions and a lot more.

Backupper is another useful tool, which comes in free and Pro editions. The freebie is fine, and it enables you to back up the files and folders on your computer to an external disk drive. It also enables complete images of the whole drive, including all the partitions to be created and stored externally. It contains a boot media creator, which creates a bootable DVD or flash drive to start your PC. The boot media runs the recovery software, and you can restore individual files or folders, or even the whole disk including all the partitions.

EaseUS Todo Backup Free 9.1 is another excellent backup utility that's packed with features for backing up your PC's disk and restoring lost files, partitions and even the whole disk. It enables you to use block-level disk imaging or sector-by-sector backups, which means the backup is identical in every way to your PC's disk. It enables you to restore everything exactly the way it was in the event of a disk disaster. Bootable recovery media can be created from within the program, which is
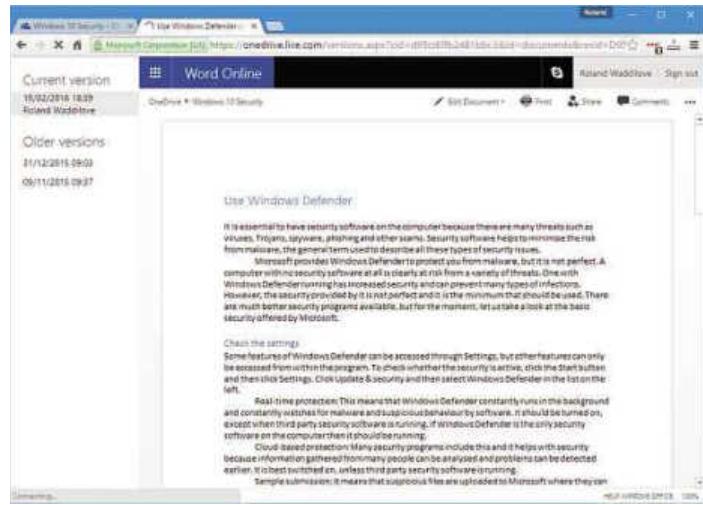
essential for when your PC's disk is so corrupted you cannot start Windows.

The options for recovering data are good for a freebie, and you can restore files, disks and partitions. You can restore to the original location or a new location, and it supports migrating Windows to an SSD. The Home edition of Todo Backup has even more features and costs £26.52.

Online Backup And Data Recovery

Online storage like OneDrive, Google Drive, Dropbox and others can help with recovering lost files and data. Each service provides several gigabytes of free storage, and there are ways to earn more, such as by agreeing to store mobile phone photos.

All of these services provide PC applications that keep a folder on your local drive synced with the remote online storage. By using these folders to store important files like documents, photos, music, videos and anything else you have, you're protected to a certain degree and, should you lose one or more files, you can often recover them.

Software	Price	Website
Backupper	Free	backup-utility.com
Backup & Recovery 14	Free	paragon-software.com/free
Rescue Kit 14	Free	paragon-software.com/free
Todo Backup 9.1	Free	todo-backup.com
Recuva	Free	piriform.com/recuva
Glary Undelete	Free	glarysoft.com/glary-undelete
Wise Data Recovery	Free	wisecleaner.com/wise-data-recovery.html
7-Data Recovery Suite	Free	7datarecovery.com
MiniTool Data Recovery	Free	minitool.com
ZAR Data Recovery	Free	z-a-recovery.com
Stellar Phoenix Windows Data Recovery	£37.88	stellarinfo.com
Stellar Phoenix Photo Recovery	£34.80	stellarinfo.com
Disk Recovery 11	£65	oo-software.com
MediaRecovery 11	£32.99	oo-software.com
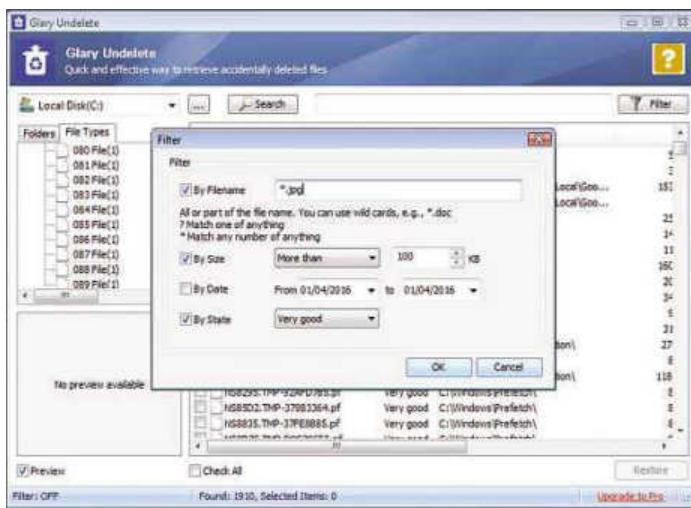
▲ *Glary Undelete enables you to find deleted files by size, date and file extension*

▲ *Recuva is a simple, free utility that scans your disk for deleted files and restores them*

▲ *Wise Data Recovery is another file undelete tool that you should have on your disk*

One way in which online storage helps is that these services provide their own trash handling and versioning. If you delete a file on your PC's drive, it's moved to the Recycle Bin and is easily recovered by opening it and dragging the file out. But what if you then empty the Recycle Bin? The file is no longer on your PC.

If the file was deleted from OneDrive, Google Drive and others, it will be deleted online too, but these services have their own bin or recycle bin. Using a web browser, go to the website and log into your account. Go to the bin or whatever it calls it, and your file will be there. Google's bin is never emptied, so deleted files will remain there forever unless you manually empty it. Files you deleted last year will still be there, and if you accidentally deleted a file and discover that you need it, it can be recovered. This can save you from disaster.

These online storage services store each version of a file, so if you create a document last week and edit it today, both last week's and today's documents are stored in your account. This is very useful if you want to recover information that was in an earlier version that you changed or deleted.

Go to OneDrive in a browser, click a Word document, for example, click the three dots in the top-right corner to display the menu, and then select Previous Versions. A panel opens on the left with a list of dates. Click a date to see the version of the file that was saved on that date. You can then edit it, save it, copy it and so on.

Google Drive and Dropbox offer similar facilities, but the menus are different. On Google Drive, for example, select a file and then click the i icon in the right corner. A panel opens, and the Activity tab lists the previous versions. Recovering lost information and previous versions is easy.

Another technique you can use if you have more than one computer with Drive, Dropbox or OneDrive is the make use of the duplication of content. Any file you put in the synced folder gets synced to every other computer with that folder. If you lost files on your online storage, remember that there's an exact copy of them on your other computer. You just need to start it up without letting it connect to the internet. Switch off your router and switch on your computer so it can't sync. Copy the files out of the synced folder before connecting to the internet or they'll be deleted.
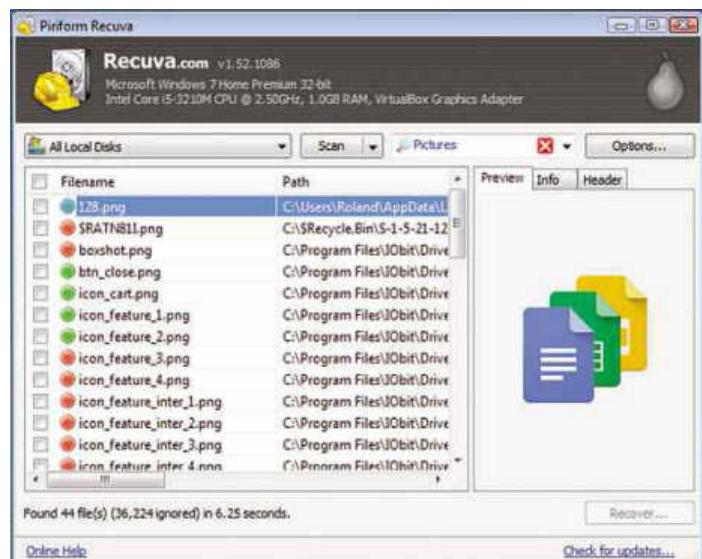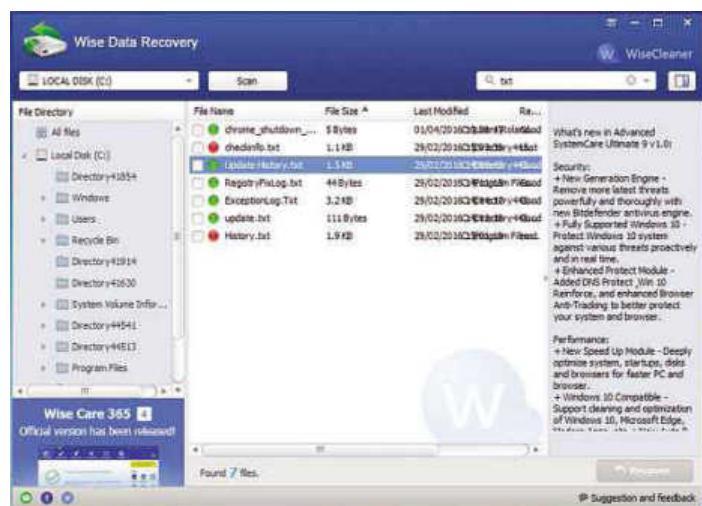
An advantage of having online storage mirrored in synced folders is that it will be backed up by backup software. There's a copy of the current files and previous ones on the USB drive you use for backups.

Free Recovery Software

Let's suppose that you don't have any backup software installed and no backups of your files. You don't use File History and you don't use online storage for your files. You have also recently emptied the Recycle Bin, so there's nothing in there either. What a crazy situation, but sadly this is more common than you might think, and people are too trusting of their computers. It works every day and never misses a beat, so users assume it will continue like that forever. It won't.

When files go missing or become corrupted, people look for some way to recover them. There are free utilities that can be used to scour the drive for recently deleted files, but you should be aware that downloading and installing software might overwrite the data and files you're trying to recover.

Being prepared is the key, and if these file recovery tools are already installed on the drive, then recovering data is a lot easier and is more likely to be successful.

Recuva is a popular utility that is available in free and Professional versions. When it starts, it asks what sort of files you want to recover, such as music, documents, photos and so on. You can look for all types of files, but this can produce a lot of results that make it hard to find the file you're after. The filters should be used to narrow down the search. You are also asked where to search for deleted files. You can search everywhere, but the results can be overwhelming on a well used computer, so it's best to choose one of the options such as My Documents, Recycle Bin or a specific disk location. There's an option to choose a media card, such as from a digital camera.

There are standard and deep scans for lost files, and a standard scan should be run first. Only if this doesn't locate the file you lost should you use a deep scan, because it produces long lists of files you aren't interested in.

Switch to the advanced mode when it has scanned the disk, because this displays a panel on the right that can be used to preview files, such as images, before recovering them. There's

> **66** **An advantage of having online storage mirrored in synced folders is that it will be backed up by backup software** **99**

a file info tab and a tab that displays the file header, both of which are useful for identifying files. The traffic light icons next to files shows the chances of recovery, with red for poor and green for good. Use the filter control to select photos, music, documents and so on. You can select a file and restore it to another drive (restoring to the same drive can cause problems), a flash drive and so on.

Other free file and data recovery software works in a similar way. Glary Undelete scans the drive and lists every deleted file it finds. You then use the quick filter box to enter a file extension like *.jpg or *.docx and so on. This reduces the number of deleted files listed and helps you to find the one you want. There's an advanced filter function, which enables files above or below a certain size to be excluded, and a date range can be selected, such as yesterday, last week, last month or whatever time period you choose. The chances of a file being recoverable is shown, and you can filter and show only those that are in very good condition.

Wise Data Recovery is more of the same. Run this free tool, and it scans your disk and displays a list of deleted files. Use the filter box to focus on the file type you want, such as *,bmp, and you can view the matching files. A traffic light system of red, amber and green is used to show whether a file is recoverable, and there's a preview page that is useful for viewing photos and text files to see if they're the right one before proceeding to recover them.

There are a number of semi-free tools, such as 7-Data Recovery Suite and MiniTool Data Recovery, which allow you to recover 1GB of data before you have to pay anything. That could be sufficient to get you out of a dire situation. ZAR Data Recovery allows you to recover lost and deleted photos for free, but you must pay to recover other types. It has a list of known digital cameras that it's compatible with, which is useful. If your camera isn't on the list, it still might work, though.

Pro Recovery Software

There are lots of free tools for recovering lost files. If you've lost files that are extremely valuable, such as wedding photos that are irreplaceable, you might want to try paid software that offers more features and better recovery features.

Stellar Data Recovery has more utilities than you can imagine, and there's a comprehensive range of them. Some are for business users, but there are utilities suitable for home users too. There's Windows Data Recovery, Photo Recovery and CD/DVD Recovery, as well as JPEG, Excel, Word, PDF and other file repair utilities. A recovered file might be corrupted, and these repair tools can help in some circumstances. Stellar Phoenix Data Recovery Home is £37.88, and Stellar Phoenix Photo Recovery is £34.80, for example.

O&O Software has two useful utilities: Disk Recovery 11 costing £65 and MediaRecovery 11, which is cheaper at £32.99. MediaRecovery is designed to track down deleted videos, photos and music files, so they can be recovered. Disk Recovery is a general tool that can recover any type of file. **mm**

▲ *O&O Software MediaRescue is designed for recovering photos, videos and music*

Top 10 OneNote Tips

The Windows 10 OneNote app is great for taking notes for work or personal projects. Get more from it with Roland Waddilove's top tips

1 Access Your Notes Online

The OneNote app in Windows 10 stores your notes in a file on OneDrive and places it in the Documents folder. If you need to access your notes on a different computer, such as a Windows 7 PC or a work computer, go to the OneDrive.com website in a browser, click the menu button in the top-left corner and click OneNote. It lists the notebooks, and after selecting the one you want, it opens in the browser.

Notebook sections are listed down the left-hand side online but across the top in the Windows 10 app. Otherwise, most of the menus and features are the same. There are differences, though. For example, the Windows 10 app has drawing functions, while the online version of OneNote can record and insert voice notes.

2 Save Notes On Your Phone

OneNote is available everywhere, so take advantage of this by adding it to your phone and tablet. Sign in with your Microsoft account to access your notebooks and notes. Wherever you are, if an idea comes to you or you need to remember something, tap OneNote on your phone and type it in.

OneNote can be run as an app, but it's also among the share options on Android and iOS. The web browser, photos and other apps on phones and tablets have share menus or buttons, and you can save the page, photo or whatever to OneNote. It then appears on your PC in Windows 10's OneNote app.

Notes shared on mobile devices are stored in a special section called Quick Notes. Select Quick Notes in the Windows 10 app, right-click a page and select Move to move it into another section.

3 Write On The Screen

Touchscreens are becoming popular on PCs and some laptops. Hybrid devices that have tear-off screens that can be used like tablets have them too. With a touchscreen, you can draw on notes and write on them with your finger. Select the Draw tab in OneNote, select the pen or highlighter, select a colour, and then just write or draw on the screen.

You can do this with a mouse, but drawing in a note with your finger or a pen is more natural. It's great for sketching diagrams and plans. There's a control to set the line width, an eraser and a lasso selection tool.

4 Show Symbols In The Margin

It's not obvious, but there's a margin on the left side of notes, which can be used to display symbols. Select the home tab, and in the toolbar, the last item in the text formatting section is a down arrow. Click it to see a list of symbols. Click Important, Question, Critical, Contact, Address or Phone Number. The symbol is inserted in the margin to the left of the note.

The symbols are just visual aids, and you can instantly see a note that is critical or important.

5 Save Webcam/Phone Photos

If you have a webcam on your computer, you can insert photos into notes. Click the Camera icon on the Home or Insert tabs, and a window opens with camera controls.

This is a bit limited with a computer, because you can only shoot something in front of it. Where this is really useful is with a mobile phone. Run the OneNote app, select a note, or tap the new note button, the§n tap the camera icon. There's an option to select an image already taken or to capture a photo with the
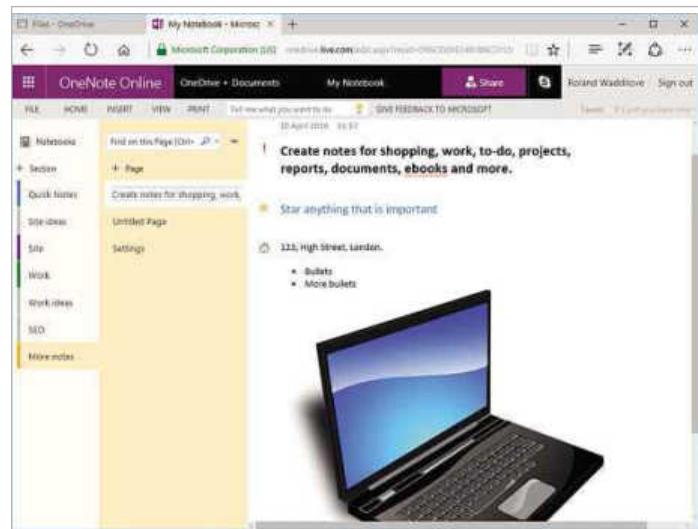
▲ *Notes created in the Windows 10 app can be accessed online on any computer*
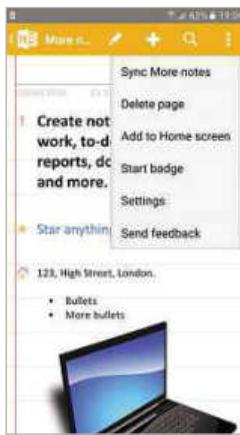
▲ *Add the OneNote app to your phone to access notes created on your PC*
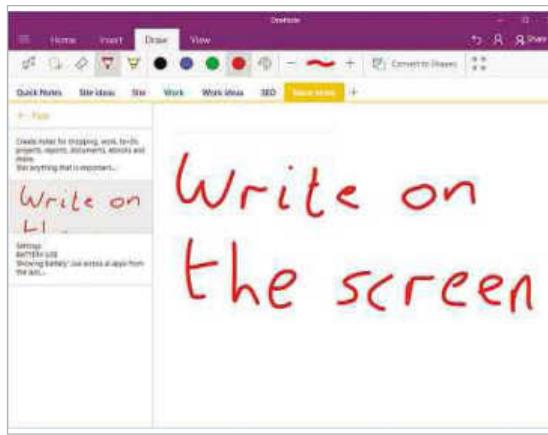
▲ *If you have a touchscreen, use the drawing tools to write with your finger*
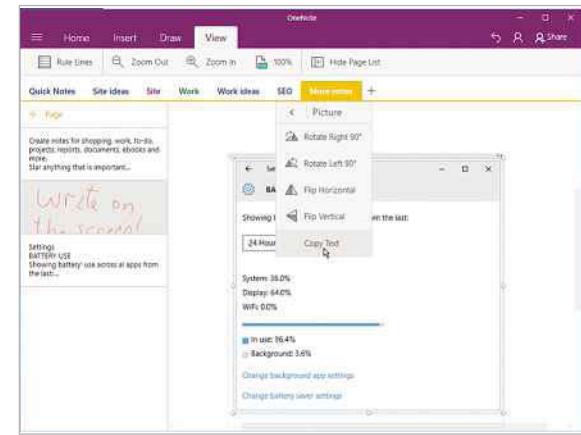
▲ *Insert screenshots or pictures of signs and documents, and turn them into text*

camera. This is a useful feature if you need to collect and store photos for a project or document.

6 Picture Tools

There are a few basic picture tools and one killer feature, and all are accessed by right-clicking a picture you've taken with a camera or inserted from the PC's disk or the phone's gallery. Right-click an image and select Picture in the toolbar that appears. Choose 'Rotate right 90' or 'Rotate left 90' to switch from portrait to landscape, for example. There are also options to flip the image horizontally or vertically.

The killer feature is Copy Text. Right-click an image, select Picture > Copy Text. OneNote uses optical character recognition (OCR) to pick out the text in an image and copy it to the clipboard. You can then paste it into a new note or another application, like Word. This feature is very useful if you ever need to scan a document and don't have any OCR software installed.

7 Add Lines And Grids

OneNote allow you to write anywhere on the page and to insert images and place them anywhere. This can make the notes look untidy and confusing if you aren't careful in placing everything. Adding lines and grids to the page can help to make the notes clearer.

Go to the View tab and click Rule Lines to see a choice of four rule lines, four grids and none. Rule lines make the background to notes look like a notepad. There are pale blue horizontal lines and a red vertical line to mark the margin. The grids make the background look like graph paper.

8 Pin Notes To Start - Right-click Note

Some of your notes might be important, and you may need to frequently refer to them. They can be difficult to find if they're buried deep in a notebook with many pages, so why not pin them to the Start menu? Right-click a page in the left-hand pages list and select 'Pin to Start'.

A tile is created for the note, and it can be dragged and placed anywhere on the Start menu. Clicking the tile opens OneNote, the notebook and the page with the note. It's a quick and easy way to get to your favourite notes.

9 Pin Notebooks To Start

A notebook can have many sections, which are added by clicking the plus button just above the notes. A section can have many pages, which are added by clicking the plus

above the pages list on the left. It's also possible to have multiple notebooks. You could have one for home and one for work, or one for each project you're working on. There are many uses for separate notebooks.

Click the menu hamburger button in the top-left corner, and click the plus sign next to Notebooks. Enter a name for it, and it's added to the list of notebooks. You can select the notebook to use in this menu, but to make it easier and quicker to access a notebook, right-click a notebook file in the menu and select 'Pin to Start'. Create a separate tile for each notebook and then it's just one click to open them.

10 Colour Code Notes

Notebooks have sections, which are the tabs across the top. To make them stand out and to make selecting them easier, they can be coloured. Right-click a section title, click Section Colour, and then click a colour.

The order of sections can easily be changed by clicking and dragging them. Drag a title left or right, and the others scoot around to make space for it. The order of pages can also be changed by clicking and dragging them in the left panel. **mm**
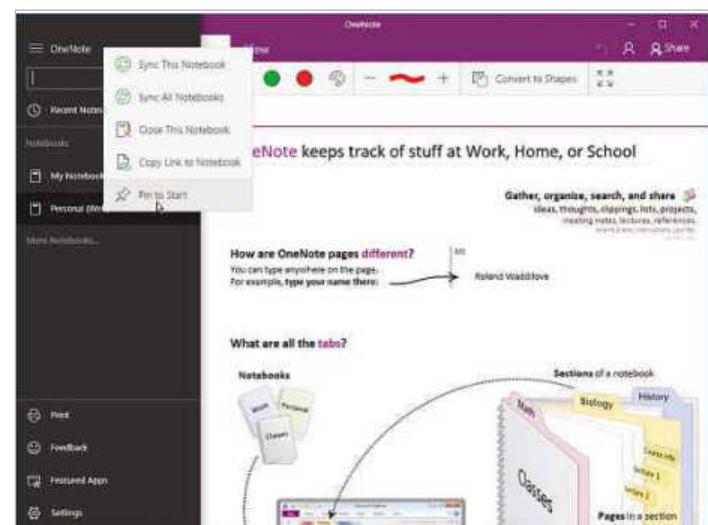
▲ *Right-click notebooks to sync them and to pin them to the Start menu as a tile*

Daily Mail Interested In Yahoo

Early days, yet

Background Removal Tool From Reallusion

popVideo 3 has smart, simple features

This is for the video editors among you. Reallusion has launched popVideo 3, a "dedicated HD chroma key editing tool with smart design features that greatly simplifies the task of background video removal."

The pitch from the company is that popVideo 3 allows users to work under various environmental conditions to make "transparent videos a reality" and it works in tandem with Reallusion's iClone real-time 3D animation engine. As the number 3 indicates, this is the latest version of the software, and this one comes with a range of smart features including automatic change of the edit mode to work with original, chroma keyed or masked videos for fast editing and export.

Also among those features are one-click background removal, a wide range of chroma key colour support, a powerful timeline editor, and flexible mask tools for working with imperfect shots. The website for more details on this is **reallusion.com**.

Yahoo's future is back in the headlines, as news of discussions with the Daily Mail's parent company have come to the fore, regarding the potential sale of the troubled internet firm.

Widespread media reports on the matter quoted spokespeople from the Daily Mail and General Trust as saying that discussions were at a very early stage and that "there is no certainty that any transaction will take place."

There is plenty of other interest in Yahoo, of course, but this latest news is particularly interesting, because it involves a UK-based firm.

Will the Daily Mail and General Trust, Verizon, Google, Time or another firm end up with what will ultimately prove to be a hugely significant acquisition, whatever the eventual outcome? We'll find out before too long: Yahoo has asked for all bids to be submitted by 18th April.

YAHOO!

Best Of British

Some fine games were recognised this year

A huge congratulations to all of the winners at this year's British Academy Games Awards.

The 2016 awards took place in London and were presented by the fine Dara O'Briain, and while *Fallout 4* was the headline winner of the Best Game award, three other titles – *Everybody's Gone to the Rapture*, *Her Story* and *Rocket League* – had even more to shout about as they picked up three BAFTAs each.

If you haven't played any of these titles yet, you really should do yourself a favour by rectifying that this weekend. The same goes for the winner of the Best Story award, the frankly brilliant *Life is Strange*.

As ever, it's a joy to see the more independent side of video gaming being so well represented.
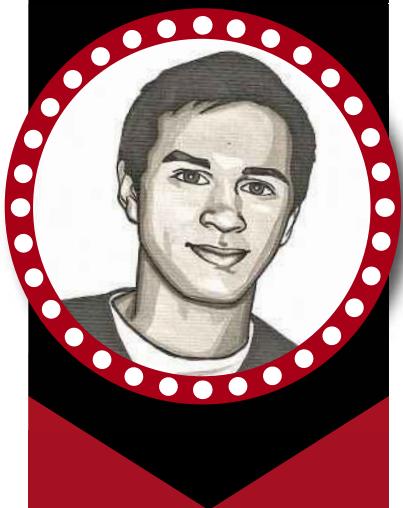
After getting a new computer or reinstalling Windows, normally one of the first things you'll do is install all your favourite programs – the software that you use practically every day.

For me, a big chunk of what I install on my computer at this point will be free software.

First of all, I download the Chrome web browser, because my bookmarks are synced to my Google account, and because I'd rather download my other programs in a browser that doesn't annoy me by defaulting to the Bing search engine.

Then I grab a copy of VLC for any video files I might want to watch.

A few years ago, I might also have downloaded OpenOffice, but these days, I do most of my word processing and so on in Google Docs.

If I don't have a current subscription to any anti-virus services, I'll also get some free web security software too.

Then further down the line, I'll probably add to this free sotware with more free software, like Audacity, Virtual CloneDrive and more.

The fact is you get almost all the programs you need for your computer with ever having to dip into your wallet.

Let us know what free software you use.

Anthony

Editor

Meanwhile... On The Internet...

After all the initial hue and cry of the Apple decryption request in the US, the reality that the tech giant was not needed to access the data on its device felt like an unsatisfying tailing off of the story, rather than the satisfying conclusion that a legal ruling would have provided (at least until the inevitable sequels, that is). However, the intervention of a third-party – and its offer to hack the phone of San Bernadino terrorist Syed Farook – raised several more interesting questions that still need to be answered... But probably won't be in the near future.

While the hack was initially thought to be the work of Israeli firm Cellebrite (**tinyurl.com/MMnet10a**), a firm well-renown for its mobile forensics work, a recent *Washington Post* report alleges that the FBI actually paid another group, which it describes as 'grey-hat' hackers (**tinyurl.com/MMnet10b**), a one-off fee for use of the exploit (**tinyurl.com/MMnet10c**).

Indeed a recent story from Reuters cites "White House sources" as saying that the payment may have actually been for a one-time use of the hack, and that the FBI may not actually know how it was done at all, or at least not have any right of ownership over the method that would allow it to reveal it to the public (**tinyurl.com/MMnet10d**). This would make sense of Apple's decision not to pursue a legal demand that the FBI reveal the flaw that afforded it access to the iPhone 5C (**tinyurl.com/MMnet10e**) at the centre of the whole furore, though it will no probably be frustrated that it cannot gain details on how it was done, and potentially patch the problem.

Of course, the really massive slice of irony we can take away from the whole thing is that it appears there was little of import stored on the device (**tinyurl.com/MMnet10f**), as some people rightly predicted (**tinyurl.com/MMnet10g**) as terrorists seem to prefer so called 'burners' rather than encryption (**tinyurl.com/MMnet10h**). That is presumably why US authorities are now trying to legislate against them (**tinyurl.com/MMnet10i**), while simultaneously trying to get their forced decryption agenda passed as law at the same time (**tinyurl.com/MMnet10j**).

This is all far from over (**tinyurl.com/MMnet10k**), it would seem. The arguments here will no doubt run and run *ad infinitum*, as long as people have tongues to argue about them. Technology will advance and move the goalposts as sure as eggs are eggs. However, the legislative battles (**tinyurl.com/MMnet10l**) and other legal shenanigans (**tinyurl.com/MMnet10n**) happening on both sides of the Atlantic at the moment make for fascinating, terrifying, viewing. A bit like the latest video from the peerless Cassetteboy, then (**tinyurl.com/MMnet10m**).

You may remember a couple of weeks back we mentioned that Twitter has been in a two-year battle with the US Govt. for the right to give its users more information on data requests (**tinyurl.com/MMnet10t**). Now, Microsoft has entered into a similar battle in the hope that it will be able to make its users aware when their emails are under surveillance (**tinyurl.com/MMnet10u**). While Twitter's beef was with the National Security Letters issued under the Foreign Intelligence Surveillance Act, Microsoft is gunning for gagging orders connected to the US-specifc Electronic Communication Privacy Act.

As part of its case, the firm noted that it had received 2,500 such legal demands for information in the last 18 months, none of which it could tell the person concerned about. Further to this, over 1,700 of those gag orders had an indefinite timespan, meaning the subject of the surveillance may never know their correspondence was being read by a third party.

In the US, such challenges are made in defence of the First Amendment of the US Constitution (**tinyurl.com/MMnet10v**). If, or how, the company may challenge similiar UK-derived gagging orders imposed under the new Investigatory Powers Bill on this side of the pond, remains unclear (**tinyurl.com/MMnet10w**).

If you're not aware of the phenomenon of Mansplaining, let us patronisingly correct that for you in as condescending way as is possible. Basically, hun, it describes when someone (usually a man) deigns to impart their wisdom on a subject to another person (generally, a woman) in language that the conscending mansplainer thinks is appropriate (**tinyurl.com/MMnet10o**) to their delicate, womanly sensibilities and inherently inferior intelligence.

It's a big thing, apparently, at least since 2008, when it was given a label in the wake of Rebecca Solnit's essay *Men Explain Things To Me* (whether it existed before this point is unclear), which has since inspired a book (**tinyurl.com/MMnet10p**). Apparently, it's endemic in our society... though we never, ever come across it in the technology industry, so it must be endemic elsewhere (**tinyurl.com/MMnet10q**).

Obviously, a central part of this phenomenon is that the ever-helpful mansplainer irks the ungrateful mansplainee without realising the offence they've caused (**tinyurl.com/MMnet10r**). The faux pas can elicit a range of responses from the simple, yet powerful, eye-roll through to attempted and/or actual murder. You've been warned.

Now you understand what we're talking about, my dears, you'll appreciate how it's possible to see this conversation between Twitter users **@voldmortsbicep** and a super-mansplainer **@grhughes82** as something bordering on performance art (**tinyurl.com/MMnet10s**).

.AVWhy?
Videos For Your Eyes... Not Necessarily For Your Brain

If you've not encountered the work of Ernest Cline, may we point you in his direction? He's the author behind the soon-to-be-a-movie-directed-by-Steven-Spielberg-no-less novel *Ready Player One,* and the equally tech-savvy tale *Armada.* Both are great, though the latter is manna from heaven for gamers, both retro and modern, which imagines an army of ace space pilots trained by computers games like Phaeton, the subject of the amazing faux-80s ad and retro emulation you can see and play at **earthdefensealliance.com**.

QUICK BITS... Co-founder of lastminute.com and all-round digital champion Martha Lane-Fox is going to join the

Caption Competition

"Stuck between a rock and a hardware place."

No space to talk... Too many captions. Enjoy!

- **wyliecoyoteuk:** "George realised that, when it came to programming, he was between a rock and a hard place."
- **wyliecoyoteuk**: "Hey guys! I found the Any k…"
- **doctoryorkie:** "Paper was a bad choice."
- **Sawboman:** "William thought his palaeontology course was overloading him."
- **JayCeeDee:** "When Fred said his laptop rocked, it wasn't this he had in mind."
- **JayCeeDee:** "Heh Heh... Rock on, Tommy!"
- **ricedg:** "Rock on Tommy."
- **bigdaddy:** "I have a lot on my mind, but this is ridiculous."
- **Thomas Turnbull:** "Wow that New Rock City Facebook game doesn't mess about."
- **Thomas Turnbull:** "Candy Crush was never like this."
- **Wudger:** "No Cortana, I said 'I want a bolder typeface', not 'I want a boulder on my face'."
- **Jon Winchester:** "Stuck between a rock and a hard drive"
- **Jon Winchester:** "Man saves laptop from extinction"
- **Frank Everett:** "That is definitely the last time I play Asteroids on this machine."
- **Frank Everett:** "Alright, so it is just a stone's throw away but you didn't have to prove it."

The winner, though, is doctoryorkie with "Stuck between a rock and a hardware place."

If you have a caption for the picture below, head to the 'Other Stuff' section of our forum (**forum.micromart.co.uk**), or email us your funnies via **caption@micromart.co.uk**, remembering to add the issue number to the email.

USB-C Adapter From StarTech

Northampton-based firm expands adapter line

StarTech.com, based in Northampton, has announced the release of a new USB-C to DVI adapter to add to its current line. The adapter comes in black or white, as photographed here, and obviously this is all about connecting a USB-C laptop to a DVI projector or monitor.

It's a compact design so it travels well and it costs £30.99. We have literally nothing more to say on the matter.

Portable Speaker With Premium Audio

Bluetooth system from Edifier

Specialist manufacturer of premium audio solutions Edifier has released the Rave MP 700. Billed as a traveller's best companion (which we'd actually argue is a fresh cup of coffee and a pack of ginger biscuits, but we digress), this portable speaker features Bluetooth 4.0 and, as you can see here, looks decent enough.

Edifier promises that this speaker will provide clear, strong audio with built-in digital signal processing and dynamic range control that should offer balanced sound for any music genre that you care to throw at it.

The battery allows continuous play for eight hours, and with a total power output measuring 36W, this promises decent audio performance for your money.

Costing £199.99, read more at **www.edifier.com**.

GCHQ Stopped Harry Potter Leak

A radio interview in Australia has revealed some interesting titbits of information, as the founder of Bloomsbury Publishing told of how the publisher had in place stringent security plans to stop any potential leaks of the Harry Potter title *Harry Potter and the Half-Blood Prince*. Indeed, the publisher even had some outside help from UK surveillance agency GCHQ.

The agency actually found a copy of the book had found its way online early, but it turned out that it was a fake. Still, talk about having friends in high places. The GCHQ gave a nice quote: "We do not comment on our defence against the Dark Arts."

SpaceX Success!

It wasn't too far back that we were hearing of video of SpaceX's failed landing, but now we have better news. An unmanned rocket, carrying a full load of supplies for the International Space Station, successfully dropped off its load before then landing safely on one of the company's docking droneships named 'Of Course I Still Love You'.

This was the first shipment in a year after flights were paused last June following a launch accident.

BlackBerry To Launch New Android Phones

Just when you think things are looking pretty bleak for BlackBerry, CEO John Chen goes and announces two new Android handsets will be launched this year.

Chen gave an interview to United Arab Emirates newspaper the *National*, in which he said that the Priv device was too high-end and that the company is planning to launch two mid-range Android devices this year, one with a physical keyboard and one with a touchscreen.

Code-Breaking Tech At TNMOC

Rare cipher machine now on display

We seem to have a lot of news from Bletchley Park at the moment, which is all good with us, as it's a fantastic place to visit. Now, the National Museum of Computing is promoting another cracking piece of tech that's on display and this one is all about the amazing codebreaking work during the Second World War.

The extremely rare Lorenz SZ42, billed as Hitler's "unbreakable" cipher machine, promises to fill in the full codebreaking story from encrypt to decrypt, with the full set of 1940s cutting-edge technology now on display at the museum. The museum claims that nowhere else in the world can you see the full range of technologies used by both the British and Germans to send and receive encrypted messages during the war.

The Lorenz machine has been given to the museum on a long-term loan basis. Only four of the 200 machines believed to have ever been made are known to have survived, so this is quite the coup for the museum. If you'd like to visit, find out details of opening hours and how to get there at **www.tnmoc.org**.
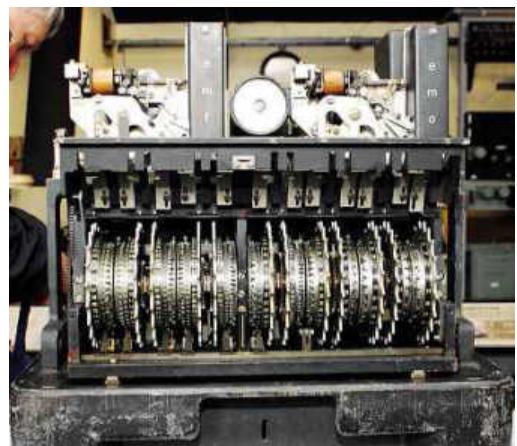
Doom DLC Soon After Launch

Open beta ran in April too

It's nearly here. The revamped Doom launches on 13 May on the usual platforms – PC, PS4 and Xbox One – and if you were lucky, you might have taken part in the Open beta which ran from 15 to 18 April. Gamers had access to Team Deathmatch and Warpath on a couple of maps and we wish we had been there with you.

As for the game release itself, the two maps in that open beta are just a fraction of what players will experience when the game is finally released, and three premium multiplayer DLC packs will be released after launch, costing £11.99 each or at a discount (of sorts) with the usual season pass deal. These packs will give gamers a numbers of new maps, hack modules, playable demons, weapons and more, with the first DLC available this summer giving access to three new maps, a new weapon, one new playable demon, one new armour set and more. Roll on May, we say.

QUICK BITS... BT says that 25 million premises can now access superfast broadband via its Openreach

Three-O2 Deal In Danger?

Regulator questions possible merger

Three's proposed deal to merge with O2 has hit something of a roadblock, as the UK's Competition and Markets Authority has sent a letter to the European Commission stating that its plans to protect consumers should the merger go ahead are "materially deficient".

The letter is pretty damning stuff and brings into question whether such a deal should really be allowed to go ahead at all. In the letter, the CMA wrote the following: "The proposed remedies are materially deficient as they will not lead to the creation of a fourth mobile network operator (MNO) capable of competing effectively and in the long-term with the remaining three MNOs such that it would stem the loss of competition caused by the merger."

Clearly, this letter isn't great news at this stage for the companies concerned. The CMA has raised genuine concerns here over a potential negative impact on pricing and competition within the communications industry. Let's wait and see.

Virtual Reality Will Make Lives Better

Most people think it will have a positive impact

A survey commissioned by Invest Bristol & Bath has been published alongside a White Paper titled 'Work, Rest and Play: How Will Virtual Reality Impact Everyday Lives?' that looks into the possible impact of virtual reality on consumers.

The survey of 2,000 people found that three quarters of consumers believe virtual reality will impact positively on their lives, with men generally more positive about it than women. Women are also more worried than men about its effect on health and family life, and virtual reality is expected to have the most impact on the gaming sector, obviously, with the entertainment and education sectors also expected to witness a big impact too.

A third of respondents to the survey had tried a VR headset, with 70% considering buying one in future.

Wind Machine Wins Prize

Latest award is a real gas

In the list of the world's wackiest prizes, China's 'Pineapple Prize' would probably rank somewhere up there.

The prize is co-sponsored by science publication Guokr.com, which named the prize 'Pineapple' because it's a fruit that has a great taste but also looks a bit strange at the same time. The idea, in case it's not entirely clear, is that the prize looks at discoveries that are both useful and amusing in good measure.

This year's prize went to a wind detector, only not the swishy, swooshy kind of wind. Yes this detector, according to reports, will solve the 'mystery' of whom bodily gases originated from by using algorithms to map out odour sources within the air.

You really couldn't make this stuff up.

Youngsters Go 'Back To The Future'

Online text adventure game accompanies exhibition

Young people from across Northern England have helped to create a futuristic (and pretty bleak, it has to be said) look at what life might be like in their local communities in 2065.

Part of the Northern Powerhouse: Last Towns Standing touring exhibition, the young individuals from Hull, Wigan and Burnley partnered Liverpool-based arts group Re-Dock in coming up with an online text adventure game, inspired by the ones we all loved playing back in the day. The adventure game, set 50 years into the future after a nuclear explosion and with intelligent robots lurking nearby, lets you click on various choices to control characters and influence the environment. You can play it yourself at **textadventuretime.co.uk/play**.

The associated exhibition showcases objects from the game and will be available to view until 7th May at Hull Central Library.

Asus Chromebook C201

Small, tough and perfectly connected

Fast, stylish and simple" is the tagline for Asus's range of C-series Chomebooks. We've already looked a few examples over the last couple of months, with the Chromebook Flip and the C200, but now we have the C201 in for review.

The Asus Chromebook C201 is a surprising entry into the Chrome OS world. Whereas normally Chromebook are often at the more cheaply built and designed end of of the mobile sector, Asus has instead created one that's a cut above the rest in terms of design and connectivity.

To begin with, the C201 features a Rockchip quad-core RK3288C processor, with an integrated Mali T764 GPU and a choice of either 2GB or 4GB of LPDDR3 memory (the version we had in for testing boasted 4GB).

Storage comes in the form of a 16GB eMMC, on which Chrome OS is installed, leaving roughly 9.6GB of space left. As for connectivity, you'll find a pair of USB 2.0 ports on one side of the C201, and on the other there's micro-HDMI, a micro-SD card slot, combo headphone and mic audio jack, and a Type-C power socket.

The C201 comes with 802.11ac wi-fi, Bluetooth 4.0, and a HD web camera that's

The Asus C201 is one of the better model Chromebooks we've looked at

more than adequate for Skype calls and recordings.

The 11.6" HD screen has a maximum resolution of 1366 x 768, and it's pretty good considering the overall cost of the C201 and the fact it's a Chromebook and not a 'true' notebook. Although the colours appear a little cool, they are more than adequate for viewing images, videos and working from the C201 for extended periods.

The design of the C201, though, is very good. It's a solid little notebook, with a familiar looking Asus keyboard layout and a surprisingly large trackpad for such a small device. There's a good solid feel to the C201, even though it weighs less than 1kg, which enables it to take some punishment from being tossed down the side of a couch, for example, and it's lightweight enough to

happily carry around for the daily commute.

In terms of performance, we didn't have any problems with Chrome OS on the C201. The various downloadable and cloud-based apps from Google work well, and there's enough processing power to enjoy HD content without any visible signs of a struggle.

Another good point to consider here is the price. The C201 can be had for around £200 or slightly cheaper if you're prepared to shop around. Considering the excellent connectivity and build quality, this is a pretty good buy.

The Asus Chromebook C201 makes for a great little notebook for longer journeys, with the battery life lasting around ten hours in our test. Also, it only took around 40 minutes to get a full charge again.

We rather liked the C201. It's a small, light, performer that's pretty tough, and it has some decent connectivity.
mm David Hayward

A Chromebook that performs better than most

micro mart

7 Quality

8 Value

8 Overall

Samsung Galaxy S7

Could this be the best Android phone of 2016?

EDITOR'S CHOICE — micro mart

▲ *The camera adopts a more professional tone with the new S7*

▲ *The design is standard but with some subtle differences. The major specs are the powerful internals*

Samsung's power drive through its hardware versions has peaked with the launch of the S7. This is a phone that's not only sleek looking and designed with many new improvements, it's also one of the best phones we've ever used, for a variety of reasons.

Although the basic look of the phone isn't something radically new, the custom Samsung Exynos 8890 octa-core processor (with four cores running at 2.3GHz and the other four at 1.6GHz), ARM Mali-T880 MP12, and 4GB of LPDDR4 memory are new.

This baseline power gives the Galaxy S7 a performance edge over the competition, coming in with a score of 6,350 on the Geekbench multi-core test – a number, incidentally, that outperforms an iPhone 6S Plus.

It comes with 32GB of storage, but it also has micro-SD card slot. Android 6.0.1, Marshmallow, takes up a chunk of the internal storage, but it's not too bad in terms of bulk. Marshmallow has a lot to offer users, with numerous tweaks and additions to the OS, and although the S7 variety isn't the vanilla version, the S7 handles everything you can throw at it with aplomb.

One of the major new features of the S7 is the excellent 5.1" QHD panel with a resolution of 2560 x 1140. Using Samsung's Super AMOLED, the display on the S7 is stunning and remarkably sharp. The colours are rich, and watching content on it is a joy to behold – despite the smaller screen size.

The camera is excellent too, although it's now only a 12-megapixel lens as opposed to the previous generation's 16-megapixels. However, it's a far more accurate camera, with a lightning fast autofocus and a professional mode that gives you more control over the exposure, and other such modes that would normally appear on a decent dedicated camera.

Although the design hasn't changed much since the S6, there are some subtle differences to take into account. The front and back of the S7 are both now Gorilla Glass 4, with a thin metal barrier between the two where the glass gently curves inward slightly. The usual volume rocker is now replaced with two separate buttons, and on the opposite side of the phone there's the power and lock button.

Everything is near flush to the surface of the phone, with the exception of the camera lens and the Home button. These are mere fractions of a millimetre away from the Gorilla Glass surface though – so much so that you'd need to run your thumbnail over them to feel it.

The battery life seems better than the previous Samsung models too, although it still doesn't last the day with heavy use. Mostly this is thanks to the better battery life optimisation of Marshmallow, but we managed to get a good 16 hours out of the battery before it needed to recharge. Also, wireless charging is available with the S7 through Qi and PMA.

The Samsung Galaxy S7 is the best Android phone we've used so far this year, and it'll probably stand the test of time well toward the end of the year too. Samsung has raised the bar with the S7 to levels that are going to be difficult to beat.

mm David Hayward

An excellent new Android phone

micro mart
9 Quality
8 Value
9 Overall

Linksys Max-Stream EA7500 AC1900 MU-MIMO Router

Linksys unleashes all the abbreviations with its latest router

O ver the past couple of years, we've seen some pretty extreme router designs hitting the market.

But from the outside, the Linksys Max-Stream EA7500 doesn't pay homage to a stealth bomber or the weekend-wear of a Sith Lord. It's large, but stylish without being outlandish, and our homes could stand more restrained gear of this variety.

Features
- Concurrent dual-band wireless operation (600 + 1300Mbps).
- Data transfer rates of up to 600Mbps on 2.4GHz (three spatial streams with 256-QAM).
- Data transfer rates of up to 1300Mbps on 5GHz (three spatial streams).
- Three removable and adjustable antennas.
- Four-port gigabit switch/1 gigabit WAN port.
- Integrated DHCP server with dynamic and static IP address assignment.
- PPTP, IPSec and L2TP pass-through.
- Storage features for external USB hard disk and flash drives (supports FAT, FAT32, NTFS, and HFS+).
- UPnP IGD and media server.
- Supports DLNA for home media management.
- Virtual USB support.
- Wall mountable.
- Dual-core 1.4GHz CPU.
- 257 x 184 x 56mm.
- Weight: 558g.

This design is built for those with a cable connection or separate modem, having a single Ethernet socket allocated to WAN use, and another four to local LAN connections.

All of the local switch ports are gigabit, and in addition to those there are also two USB ports on the rear of the EA7500, one each of USB 3.0 and USB 2.0. Those can be used for some basic file sharing, media distribution through a built-in Twonky DLNA server and even via FTP.

I've seen routers offer USB 3.0 ports before and then deliver USB 2.0 levels of performance on them, but the EA7500 doesn't. Using a high-speed USB flash drive, I was able to read and write at 60MB/s, which isn't the best I've got out of that hardware, but it's certainly better than many other router ports I've tried.

But the major selling point here is the AC1900 spec wi-fi that can simultaneously operate on both 2.4GHz and 5GHz, getting 600Mbps and 1300Mbps from each of those frequency ranges respectively.

With three antennas and beam forming tech, this is a technically a MU-MIMO (multi-user multiple-input and multiple-output) device, allowing it to service at least 12 devices over wi-fi without tripping over its own connectivity.

That's especially useful if you live in a terraced house or

apartment, where you've got lots of overlap from neighbours wi-fi or challenging structural interference. I can't guarantee that the EA7500 will fix all your problems, but it's certainly superior to any older 'n' class router, irrespective of how many antennas that has.

In testing it was slightly shy of the best scores I've seen for an AC1900 router particularly on 2.4GHz side, but not poor by any stretch.

Where I'm less enamoured with the EA7500 is with how Linksys wants to push the users to a cloud-based account system. Yes, I can follow how this could be great for someone with multiple homes and routers, but for most home users, creating an online account is just another

hoop they're being asked to jump through.

Being told on my Android phone that my browser (Chrome) wasn't compatible

> ❝ **Configuration is also an odd mix of being wonderful and supremely irritating** ❞

with the web interface and that I'd need to download the app also irked me.

Configuration is also an odd mix of being wonderful and supremely irritating, depending on how you decide to deploy the EA7500. It's best suited to

those wanting to drop it in as a direct replacement of their existing router, where the smart setup will guide you through with the minimum of input.

My problems started when I declined the automated configuration approach and decided I wanted to run this purely as an access point.

Getting the EA7500 to work in that context proved a true headache, because while

there are options for VLAN, advanced routing and wi-fi bridge mode, there is no way to easily use it as an access point without using the WAN port and segmenting the network accordingly.

I tried disabling the DHCP and providing a static IP, but the router just wouldn't accept it. I'm sure you can set this up, but it's a good example of how the going can become challenging once you've wandered off the predefined path.

My final moan is that the slick web interface includes a speed test that requires Adobe Flash Player 8.0 to be installed on the PC. Seriously? Flash is no longer a technology that users should be encouraged to install, because it's patently not secure.

Those points aside, this is a well-built, effective piece of router technology that is competitively priced and specified. If you fancy a wi-fi upgrade, then you might do well to consider this option, but those wanting the fastest possible wi-fi need to look elsewhere.

mm Mark Pickavance

Decent AC1900 technology for cable broadband users

micro mart

7 Quality
8 Value
7 Overall

SL450A GO

With one handset, **Michael Fereday** makes a dual connection

Is it a landline DECT phone? Is it a VoIP phone? In fact, the Gigaset SL450A GO offers both options, either individually or in partnership. This product also has the capability to block unwanted nuisance calls.

Available in either dual or single handset packages, with my review being based on the latter version, the Gigaset SL450A GO consists of the handset unit, base station, docking station, leads for connection and power provision and a battery pack. For use with the plain-looking base station and docking station, the two power leads have different types of connection plugs so there can be no confusion over which lead connects to which unit. While the docking station's main task is to charge the handset's internal battery pack, the base station, which can handle up to six handsets, links to a landline and / or a router for VoIP communication. Appropriate leads are provided for both types of connection.

Following a short delay as the base station searches for and registers detected handsets, the landline network setup is straightforward and easy. A more complicated process is required for the VoIP link-up. A wizard, available from the handset or browser, will guide you through the procedure for creating an IP account as you supply information that includes

service provider and user ID. One advantage of VoIP connectivity is that you get free phone calls to other Gigaset GO users.

The handset features a 50 x 38mm colour LCD screen occupying the top section. Arranged below the screen is a standard arrangement of left and right soft keys, control keys and a 3 x 4 alpha-numeric keypad. Positioned on the base of the handset are two contact strips for charging the unit while seated in the docking station and a micro-USB port for data exchange with a PC. Data can also be exchanged using the built-in Bluetooth feature. A jock socket on the left side of the handset allows you to connect a headset.

With a fully charged battery, you should expect 12 hours of talk time or 200 hours on standby. When used indoors, the handset has a range of up to 50

metres, increasing to 300 metres when used outside. The handset can send and receive SMS messages, plus store up to 55 minutes of voice messages on the answer machine. A local phonebook can hold 500 entries with fields for first and last name, various numbers, email address and photo.

As mentioned earlier, the SL 450A GO can block unwanted nuisance calls. Annoyingly, this particular feature is not covered in the printed user guide. You will need to download a more comprehensive version from the company's website. In order to activate this feature, you'll need to drill down through a number of levels in the menu system to turn on settings. You can store a maximum of 15 numbers on the blacklist for this phone. Judging by the number of unwanted nuisance calls I get, I feel this number is rather on the low side.

The Gigaset SL450A GO has an impressive list of features, including a baby monitor, plus live newsfeeds and weather updates with an internet connect. However, it's better suited to more experienced users who won't be put off by some of the setting adjustments that need to be made. **mm** **Michael Fereday**

Useful for those requiring landline and VoIP features

micro mart

8 Quality
7 Value

7 Overall

MSI Z170A Gaming Pro Carbon

A motherboard where performance and visual effects come together

EDITOR'S CHOICE micro mart

Motherboard effects are a growing branch of the component market. Rather than opting for a separate LED lighting strip, most motherboard manufacturers are now incorporating lighting effects directly onto the PCB itself – even with extra connectivity to expand the lighting too.

The MSI Z170A Gaming Pro Carbon is the latest model that is designed to deliver great mid-range performance, as well as some eye-candy.

The Gaming Pro Carbon is a sixth-generation Intel Socket 1151 board with four DDR4 memory slots, three PCI-E x16 slots and four PCI-E x1 slots. It also has SATA Express, an M.2 port, six SATA ports, and on the rear IO plate you'll find a USB 3.1 Type-C port, one USB 3.1 Type-A port, four USB 3.0, HDMI, PS/2, gigabit Ethernet, DVI and optical S/PDIF.

The Gaming Pro Carbon is a well stocked motherboard, that's much is apparent. However, beyond the technology on the board itself, there's a lot more going on with the design. It's engineered with a black carbon fibre reinforced polymer, which not only improves the strength of the board but also adds a jet-black look to the surface. This greatly improves the look of the LED effects when they're up and running.

▲ *The MSI Z170A Gaming Pro Carbon not only looks great, but it's a great performer too*

▲ *The added effects and technology used are a steal at £120*

Speaking of which, the LED lighting on the Gaming Pro Carbon comes in several parts. There's an LED line along the audio circuit, which delivers a red glow along one side and emanates through the rear IO ports. The second part is an RGB strip that runs down the right-hand side of the Gaming Pro Carbon, next to the ATX power connector.

The lighting can be controlled and customised by using the MSI Mystic Light software. There are four main modes on offer: Static, Breathe, Gradient, and Gaming and Music. The overall effect can be quite stunning when applied correctly and when fitted to the appropriate case, and the LED strip can be quite bright when at its peak level.

Other than the lighting enhancements inherent to the Gaming Pro Carbon, the motherboard naturally comes with MSI's usual high degree of engineering featuring solid capacitors, improved bandwidth

via the LAN Gaming Manager, far better audio quality thanks to the Audio Boost Nahimic Sound Technology, improved protection against power surges, and the excellent Click BIOS 5. That alone is enough to keep most system builders happy, without even touching on the LED side of things.

Get the right kit in place, such as an Intel i7-6700K, 16GB of DDR4 memory and a pair of decent GPUs in SLI or CrossFire, and you've got a pretty impressive system on your hands. There's also plenty of room around the CPU for a more elaborate air or liquid cooling solution.

Normally an LED motherboard of this quality would cost in excess of £180 and beyond, but MSI has managed to sneak the Z170A Gaming Pro Carbon in at a more than reasonable £120, which is pretty impressive considering what you're getting from the motherboard.

All in all, this is a great motherboard even before we get into the lighting effects. With the additional LED options, though, and the low price, the Gaming Pro Carbon is certainly one of the best examples we've seen yet. **mm David Hayward**

A superb motherboard, with the added benefit of LED lighting

micro mart

9 Quality
9 Value
9 Overall

Huawei Watch

Want to know the time. Ask Michael Fereday with his Huawei Watch

The Huawei Watch brings together the functionality of a watch, fitness tracker and a two-way link to a smartphone, whether of the Android or iOS persuasion. Befitting its title of 'Watch', this device's appearance could easily be mistaken for a traditional wrist-watch with its matte-black casing and leather strap. There's even a small, protruding knob whose sole purpose is to revert to time-keeping mode from other views supported by this product. The watch element has a diameter of 9.42mm and a thickness of 11.3mm, which makes it slightly larger than my usual Casio timepiece.

At the heart of the Huawei Watch beats a Qualcomm Snapdragon 400 processor with access to 512MB of RAM. You get 4GB of internal storage for downloaded apps and the like. Protected by a layer of sapphire glass, the Watch's AMOLED screen delivers a resolution of 400 x 400 rated at 286ppi. With a contrast ratio of 10000:1, the screen produces bright clear images in various lighting conditions, despite the fact that Huawei took the decision not to include an ambient light sensor to automatically adjust screen brightness.

While there's no ambient light sensor, other types of sensor have been included. There's a gyroscope and an accelerometer, which combine to provide six-axis motion functionality. Also built into the Watch are a barometer, vibration motor, step counter, calorie usage and a heart rate feature. Unlike the other sensors, which automatically carry out their tasks, the heart rate sensor needs to be manually activated. As I have an irregular heartbeat, I was not too surprised that this feature produced figures that were variable.

When setting up this device, I opted to pair it with an Android smartphone (Huawei P8), although it would have been possible to use a member of the iPhone family. In order to complete this task I needed to download and install the Android Wear app. The pairing process is carried out via Bluetooth. Using a combination of the app and prompts displayed on the Watch display, various settings can be established, with swipe gestures being required to work through different screens.

While some might regard it as merely window-dressing, the Huawei comes with a choice if 41 different faces. If that's not enough, then others can be downloaded. You can choose your particular favourite or switch as the mood takes you. Even though some of the faces are familiar, there should be enough differences for a reasonable selection choice. I tended to opt for time displayed digitally in the lower half of the screen with the upper half showing available battery capacity, plus steps taken and calories used.

Once set up, the Huawei Watch can receive notifications from the paired smartphone. It can also provide a link in the opposite direction. You can use the Google Speak feature to direct commands to the attached smartphone. These commands can cover various features such as running a music-playing app.

In tests, I found that the best I could hope for was 32 hours of light use as the 300mAh battery went from fully charged to completely drained. Recharging the Watch is carried out use a supplied charging unit that connects magnetically to the device. Charging is reasonable quick, with a full charge taking just over two hours. With this product I would suggest a routine of charging the Watch on a nightly basis.

mm Michael Fereday

A stylish device that requires almost daily recharging

micro mart
9 Quality
7 Value
7 Overall

Micro Drone 3.0

Take to the skies with this tiny flier

EDITOR'S CHOICE
micro mart

DETAILS
• Price: £151.89
• Manufacturer: Extreme Fliers
• Website: goo.gl/RGSLfl
• Requirements: Android or iOS device for the app

2016 is certainly shaping up as the year of the drone. The market has expanded considerably in recent months, with each newly released model offering more and more functionality.

Extreme Fliers, a UK-based company, has recently launched its newest palm-sized model, the Micro Drone 3.0, designed for both novices and more experienced pilots.

The Micro Drone 3.0 is an interesting bit of kit. While measuring just 50 x 145mm and with a rotor diameter of 55mm, this tiny flier manages to pack in some decent features. It's a quadcopter that houses an accelerometer, six-axis MEMS gyroscope and contra-rotational motors so you can fly the drone upside down.

Flight time off a full charge is rated at eight minutes, but we managed to get just over ten minutes off the 550mAh lithium battery. Its top speed is 45mph, and when using the 2.4GHz handset, it has a range of up to 500ft.

The icing on the cake here, though, is the magnetic attachment of a HD camera on the underside of the Micro Drone. The camera is stabilised by an incredibly small gimbal (the world's smallest, no less), and it can capture the video on an SD card, if one is inserted in the camera module, or it can be streamed directly to a phone.

▲ *The Micro Drone 3.0 is a fantastic little device*

This is where things start to get interesting with the Micro Drone. The live streamed video can be set to a virtual/first-person view, with the aid of the included VR cardboard heatset, with a resolution of 720p at 30fps. That way, you can effectively get some

> ## " A fantastic little device that's ideal for beginners and more experienced users "

amazing HD footage from well above the ground, while controlling it as if you were personally flying in the drone.

A lot of drones offer this, but to see it from something that's small enough to fit in the palm of your hand is really quite amazing. Furthermore, with the Micro Drone app, you're able to ditch the bulky handset and control the drone via your phone or tablet by connecting to the drone's wi-fi signal.

Finally, if you fancy improving the looks of the Micro Drone 3.0, the company is launching a set of 3D printable designs that can easily be snapped in to

replace the standard body. So instead of controlling a drone, you could instead be flying a remote controlled dragon. It's a clever concept, and one that'll surely appeal to the user base.

Actually flying the Micro Drone 3.0 is relatively easy. There are three speed settings on the

handset that can help you break into the flying experience: Slow for beginners, Fast for those who want a highly responsive drone, and Insane for expert flyers. The handset can also be configured with a Home Point, whereby the drone will return to a preset position.

There are also countless other flying features incorporated into the handset and the drone. The usual casual and stunt modes are there, along with adjusting the trim settings, and there are different modes that will allow you to roll the drone as opposed to simply turning left or right.

▲ *You can control it either with the handset, smartphone or both. Even with a VR headset*

The Micro Drone 3.0 is a fantastic little device that's ideal for beginners and more experienced users. There's plenty to keep you hooked, even without the camera module, and there's room for the product to grow and improve over time.

If you're looking for a great starter drone, then this is one to consider.
mm David Hayward

A great little drone, that's tons of fun and easy to fly

micro mart
9 Quality
8 Value
9 Overall

Single-bay NAS Units

Western Digital My cloud

DETAILS
• **Price: £150**
• **Manufacturer: Western Digital**
• **Website: goo.gl/ARLwP1**
• **Requirements: Gigabit Ethernet for best results, any modern browser**

⌃ *It's quick and easy to use*

Single-bay NAS units aren't quite as popular as their multi-bay relations, for obvious reasons. There's no redundancy, fewer ports, less connectivity, and with some you lose a lot of the better features you'd find on a bigger product.

However, they do have a place in the home, office or enterprise environments, so we have six on test to see which will serve you best.

Western Digital has offered users a number of NAS and networkable external drives in the past that are all designed to resemble the shape of a book. The My Book series and now the My Cloud range of units rarely alter in their appearance, but they house different specifications across the brand. The My Cloud range, comes in

⌃ *The WD My Cloud is certainly a good-looking NAS unit*

a range of different capacities: 2TB, 3TB, 4TB, 6TB and 8TB.

It's a good-looking unit, encased in white plastic, which gives it that expensive Apple kind of feel. It's obviously a single-bay product, so it lacks any redundancy, but there's a handy USB 3.0 port around the back next to the gigabit Ethernet port that can be used to further extend the backup, but there's no option to include a USB networked printer.

The software is as you would expect from such a contained unit: simple enough, with just a smattering of advanced abilities. Naturally, the emphasis here is on personal home cloud access, so you can sign up for the WD My Cloud account during the initial setup wizard, but a limited cast of NAS features do make an appearance, such as DLNA. The built-in My Cloud OS 3 is what drives the unit and, for what it's worth, it's really rather good.

Managing your personal cloud within the WD software is pretty simple. The interface is easy to read, provides lots of visual clues as to what's going on and makes things like media sharing a simple task. It's basically a NAS unit for those who don't want to be bothered with trivial matters such as protocols and the like. That's not a bad thing; it's just perhaps a little too simple and too much

of a walled-garden approach for more advanced users.

Mind you, regardless of the simplicity of its interface, the My Cloud is a fairly quick device. The 60MB/s write speed for our 4GB test file isn't too shabby at all, and reading came in at around 70MB/s, which is more than enough for both media serving and as a network backup resource.

Gaining access through the accompanying apps, available for Android and iOS, is again simplified, although we found this to be a terribly slow experience and prone to frequent screen freezing and crashing on our Android tablet.

To conclude, the WD My Cloud is a good, quick and simple to use network storage solution. The 4TB unit we had for testing is ample for most users' storage requirements and, of course, the 8TB will last you for quite some time to come.

micro mart

8
Quality

7
Value

8
Overall

Buffalo LinkStation Live 1TB

DETAILS
- **Price: £190**
- **Manufacturer: Buffalo**
- **Website: goo.gl/1OPbe0**
- **Requirements: Gigabit Ethernet for best results, any modern browser**

The Buffalo LinkStation Live (1TB model in this case) is a single-drive NAS unit much in the same vein as the Western Digital My Cloud. In fact, aside from the shape of it, there's not a lot of difference between the two.

It's designed primarily for home users who wishes to have almost instant access to their files from anywhere, and it comes with a print server, DLNA media server, FTP, Flickr and iTunes support. It also has the backup software NovaBACKUP included, and there's support for Apple's Time Machine.

As we mentioned, it's a single-drive device supporting drive sizes of 1TB, 2TB and 3TB. It has a single USB port and gigabit Ethernet, and the fact it's a fanless drive enclosure means it's reasonably quiet when in operation.

The Buffalo LinkStation stands at 150 x 175 x 25mm and can be stood vertical using the foot stand or horizontally placed. It's a decent design, finished along the edges in a glossy black plastic with a slightly grey top and bottom. Looks aside, it's a reasonably compact unit, with the power and Ethernet port located around the back of the unit, and a blue LED at the front to signify that it's on and working.

⌃ *The Buffalo LinkStation Live is at the end of its shelf life these days*

⌃ *It's nowhere near as high a performer as its sucessor*

The Buffalo software is decent and includes everything you'll need to identify the device on the network and get it up and running. The free WebAccess service allows you to create a personal cloud and gives you the ability to share files with anyone on the internet, although this felt a little clumsy, especially once you've used the WD My Cloud. On the plus side, the WebAccess service also comes with an app for iOS and Android, which worked much better than the My Cloud in our opinion.

But despite the decent software and hardware, the LinkStation didn't overly impress. The DLNA media server, for example, was picked up by our DLNA certified devices but only after several attempts at trying to locate it. Other DLNA NAS units worked almost instantly, but for whatever reason, the LinkStation decided to take the scenic route around the network. Also, once the HD media we tested started playing, we were plagued with frequent buffering and glitches in the image quality, which suggested a strangled network connection.

Likewise, the WebAccess service didn't exactly thrill us, and we found it a little clunky, and we experienced some nasty and unnecessary timeouts. We also found it took an age to wake up the drive after it went into its Eco Timer function. Although the Eco function is great, especially considering the rising cost of energy, it probably used up what was saved by spinning the drive up to speed and slowly activating the network port.

The LinkStation Live is reaching the end of its shelf life, though, with the LinkStation 210 now being the main single-bay Buffalo NAS unit. That said, it's still available and quite pricey considering its age.

micro mart
5 Quality
3 Value
4 Overall

Single-bay NAS Units

Buffalo LinkStation 210

As we mentioned in the Buffalo LinkStation Live review, the LinkStation 210 is its successor and a better model to consider.

It currently comes in three different capacities: 2TB, 3TB and 4TB. As with its predecessor, it features a gigabit Ethernet port and USB 2.0. It measures 130 x 205 x 45mm, so it's a bigger unit, but not by much. There's also a function button at the rear of the 210, which can be used to set up a direct copy, to dismount USB devices or to initialise any settings.

In terms of software, there's NovaBACKUP and, unique to this model, there's the NAS Navigator 2 software. NAS Navigator 2, as the name suggests, lets you connect to the LinkStation 210 and adjust its general properties, as well as enabling you to view its contents, and create and share folders.

As for NAS sharing duties, the LinkStation 210 has DLNA, Twonky Media Server, a print server function via the USB port (as well as a backup function) and a BitTorrent client too. The apps for both iOS and Android work just as well as they did with the LinkStation Live unit. Incidentally, there are two apps available with the 210: the WebAccess app we looked at with the other Buffalo product and a Smartphone Navigator

▲ *The LinkStation 210 is a better drive from Buffalo*

> **❝ The biggest draw of this NAS drive has to be the low price ❞**

app. The WebAccess app worked as flawlessly as it did with the LinkStation Live, but the Smartphone Navigator never got beyond trying to find the 210 on the network.

However, the biggest draw of this NAS drive has to be the low price. The 3TB LinkStation 210 we had for testing costs significantly less than the older LinkStation Live, by nearly £100. Although there was some difference in price across

the internet, this model averages out at around £100.

Obviously the greater capacity helps too, but the Buffalo LinkStation Live also had media playback problems and low transfers speeds. Thankfully, these appear to have been rectified with the LinkStation 210. The media element worked perfectly fine, with our devices finding the LinkStation and playing our content. As for transfer speeds,

▲ *The price is good too, with decent performance*

the 4GB test file was written at a speed of 53MB/s on our network, while a read speed of 60MB/s was recorded, compared to the poor 20MB/s write and 28MB/s read from the LinkStation Live.

The Buffalo LinkStation 210 is a competent single-drive NAS unit. There's enough performance to keep users happy and good enough software for most users' needs. The price is appealing too, for the amount of storage available.

micro mart

7 Quality
8 Value
7 Overall

Seagate Personal Cloud Home Media Storage

▲ *The Seagate PCHMS is a different designed NAS*

◄ *It's certainly good and performs well too*

The Seagate Personal Cloud Home Media Storage systems are a collection of devices in both single- and dual-drive setups, with a variety of different storage options. The single-drive version is available as a 3TB or 5TB unit, while the 4TB, 6TB and 8TB models are two-bay boxes.

The Seagate PCHMS features a gigabit Ethernet port and two USB ports. The USB port located on the side of the unit is USB 3.0, while the one at the back, next to the Ethernet port and the power button, is USB 2.0.

The design of the PCHMS is quite different compared to the other NAS units in this group. Rather than opting for a more traditional vertical unit, Seagate designed it to sit horizontally. This of course means it won't look out of place among set-top boxes and so on, but it does mean you'll need to find room on a shelf for it.

It measures 119 x 235 x 48mm and weighs roughly 1.2kg. The top is a glossy black plastic affair, while the sides have a matte finish. On the front there the Seagate name, with a single LED on top to indicate power and activity. It's certainly a good-looking device and an interesting design.

In terms of software, once you've set up your Seagate account and the name of the device, you'll be able to stream content via Plex and Seagate Media. It also has basic support for hosted WordPress sites, and there's also a BitTorrent client to download (legal) stuff while your network isn't so busy. It's worth noting that the Seagate Media app is available for iOS, Android, Windows Phone and Kindle devices.

The Seagate PCHMS interface is laid out simply, and it's easy to use. You can happily create folders and

> **Seagate has managed to pitch the price of the PCHMS at a realistic level**

share them, as well as create separate user accounts with access to those shares.

As for performance, the Seagate PCHMS didn't do too badly. The write speed of our 4GB file was 58MB/s, while the read speed was a decent 74MB/s.

Thankfully, Seagate has managed to pitch the price of the PCHMS at a realistic level. The 3TB single-drive version we tested costs just £110, which isn't too bad. True, the Buffalo LinkStation 210 is cheaper on average, but it

was slightly slower in our tests, and it doesn't have the interesting looks and design that the PCHMS enjoys.

The Seagate PCHMS is a pretty good single-drive NAS device. It's easy to use and will fit neatly into almost any network.

micro mart
8 Quality
8 Value
8 Overall

Single-bay NAS Units

Synology DiskStation DS115j

Synology has its eye on the ball when it comes to manufacturing high-quality NAS systems for the home, small offices and enterprise environments. Its product range is vast, but in this instance, we're looking at the DS115j.

The DS115j can be sold either as a barebones shell without an internal drive fitted, allowing you to install your own, or with a pre-installed 3.5" or 2.5" SATA hard drive between 1TB and 8TB in size.

It features a Marvell Armada 370 88F6707 800MHz processor and 256MB of DDR3 memory to help drive the performance, and in terms of connectivity, you'll find gigabit Ethernet and a pair of USB 2.0 ports.

It's a standard Synology NAS design, measuring 224 x 166 x 71mm and weighing 700g (without a drive fitted). It's finished off in a rectangular white plastic, with Synology lettering along the sides, which also conveniently acts as ventilation for the internal drive. In addition to this, there's a large 60mm fan at the rear of the unit.

While it won't win awards for its looks, the Synology DS115j is one of the most comprehensive NAS units in the group. In comparison, the other models from Buffalo, Western Digital and Seagate

▲ The Synology DS115j is an exceptional NAS unit

▲ It's quiet and does just about everything you'd expect from a NAS

all seem like external drives, whereas the Synology offers a more powerful platform to work from with its excellent DiskStation Manager 6.0 operating system.

DSM 6.0 OS is the heart of the DS115j, with an intuitive interface that's easy enough

Naturally, it's fully DLNA capable, with a variety of media servers available, but it can also be used as a surveillance station, VPN server, transcoding video station and web server. You can even use it as a note station to keep track of content-rich shared notes. In fact, there are around 110 different apps available to download and install for the DS115j.

As for performance, the DS115j had an impressive write speed of 82MB/s and a read speed of 91MB/s. This is more than enough for media duties, as well as comprehensive backup routines involving several computers at once.

As you would expect, this level of performance and control demands a higher than average price. The 3TB unit we had in to test costs £185, which places it slightly behind the older Buffalo unit we tested. For those who want to supply their own hard drive, though, you can pick up the DS115j for around £80 as a barebones shell.

The Synology DS115j is a formidable NAS unit. It's remarkably quick and powerful, yet easy to use, and despite the it's fairly basic looks, it's one of the best single-bay units we've tested.

for beginners while still being comprehensive enough for those who are more technically advanced. Not only that, but it's also a system that can easily handle a maximum of 512 user accounts, 128 groups, 256 shared folders and 64 concurrent connections.

micromart

9 Quality
7 Value
8 Overall

QNAP TS-131

QNAP is very similar to Synology in that the company offers a range of NAS systems for enterprise setups, small office and home users. QNAP, though, has always had the advantage with its bigger multi-bay NAS units, because it tends to give a little more in terms of performance, features and software.

The TS-131 is the direct competition of the Synology DS115j, so it'll be interesting to see which comes out on top. The TS-131 is powered by a Freescale ARM Cortex A9 dual-core 1.2GHz processor, with 512MB of DDR3 memory and a further 512MB of flash memory.

The drive is available as a barebones product without a hard drive, but the version we had came with a 4TB SATA drive. As with the DS115j, the maximum size is currently 8TB.

Connectivity is excellent, with a gigabit Ethernet port, three USB 3.0 ports (one at the front and two at the rear) and a eSATA port at the back. The dimensions of the TS-131 are 225 x 168 x 73mm, and it weighs around 1kg without a drive present.

Where Synology has its DiskStation Manager operating system to drive the software side of the NAS along, QNAP instead uses its Linux-based QTS. This allows for a near identical number

⌃ *The QNAP TS-131 is the fastest single NAS drive we've tested*

of shared folders, connected users, user accounts and so on as Synology offer. The same goes for the number of apps available for the OS, with QNAP having around 90 apps available for this make and model.

There are multimedia apps, education, entertainment, content management, business, backup and sync, home automation, surveillance and so on. Needless to say, you'll find something in there that'll work with whatever project you may have in mind.

As for ease of use, we think the QNAP QTS may

have the edge over the Synology DSM. QTS is a lot easier on the eyes and seems to flow from one section to the next, when initially setting

> ## 66 Its performance and the quality of its operating system are excellent 99

the drive up, in a more fluid manner than the competition. Also, when you want to get into the more advanced sections of the NAS and networking side of things, QTS still manages to keep the interface uncluttered and simple, while offering more detailed options at times.

In terms of performance, our 4GB file transfer over the network saw a write speed of 86MB/s and an incredible read speed of 93MB/s. That's faster

⌃ *It's incredibly expensive*

than the DS115j, but not by a huge amount.

Although the design of the QNAP TS-131 won't win awards, as it's very much a formal-looking NAS unit, its performance and the quality of its operating system are excellent. However, the model we had for review costs £290, which is pretty steep even for 4TB of storage. If you're after the barebones shell, then it'll set you back around £120.

micromart

Quality 9

Value 6

Overall 8

Synology DiskStation DS115j

Although the QNAP TS-131 is faster, has more connectivity and has a slightly better OS, the Synology DiskStation DS115j has everything you could ask for from a modern NAS.

It's only slightly slower than the competition, and there's lots to get your teeth into from its app store. Plus it's over £100 cheaper than the QNAP unit.

Western Digital My cloud

The Western Digital My Cloud is a surprisingly good single-bay NAS box. Although it doesn't have quite the level of performance or features that QNAP and Synology offer, it's a well-balanced drive that is discrete and easy to use.

However, if money is no object, then the QNAP TS-131 is the one to pick up from this group.

How We Tested

Each NAS unit was connected to a dedicated gigabit network, with which we transferred a single 4GB file from a connected laptop to each of the units. We also looked at the ease of use in setting up the units, as well as what services and features each provided.

	Western Digital My Cloud	Buffalo LinkStation Live	Buffalo LinkStation 210	Seagate Personal Cloud Home Media Storage	Synology DiskStation DS115j	QNAP TS-131
Price	£150	£190	£100	£110	£185	£290
Dimensions	170 x 139 x 49mm	175 x 150 x 25mm	205 x 130 x 45mm	235 x 119 x 48mm	224 x 166 x 71mm	225 x 168 x 73mm
Weight	1kg	1.1kg	1.1kg	1.2kg	700g (without drive)	1kg (without drive)
Capacity Tested	4TB	1TB	3TB	3TB	3TB	4TB
Max Capacity	8TB	3TB	4TB	8TB	8TB	8TB
USB ports	1xUSB 3.0	1xUSB 2.0	1xUSB 2.0	1xUSB 3.0, 1xUSB 2.0	2xUSB 2.0	3xUSB, 1xeSATA
Write Speed	60MB/s	20MB/s	53MB/s	58MB/s	82MB/s	86MB/s
Read Speed	70MB/s	28MB/s	60MB/s	74MB/s	91MB/s	93MB/s

Component Watch

Intruiged by the idea of a curved screen? Here are a few bargains to mull over

Curved TVs have already made inroads into the home entertainment market, giving viewers the chance for ultra-wide and impressively cinematic visuals. If you use a PC for your entertainment, however, you don't have to miss out as curved monitors are now available as well. They're often pricey, yes, but we've done our best to find the cheapest prices they can be bought for. If you want the latest in visual technology, here's what your options are.

Deal 1: Samsung S27E510C
RRP: £240 / Deal Price: £190

This 27" 1920 x 1080 monitor offers a full HD display, as well as being wall-mountable and supporting HDMI imputs. That's not a bad package for the relatively low price, but it's also slightly curved as well. Perhaps not as much as some of the others on this list, but enough to get you the benefits a curved screen can offer, especially if you're viewing it up close. Add to these features its ultra-bright game mode, 4ms response time and the fact that it's an IPS panel, and it adds up to great buy, curved or otherwise!
Where to get it: Ebuyer (**bit.ly/26204zs**)

Deal 2: Samsung S29E790C
RRP: £470 / Deal Price: £345

If you want a more convincing curved screen you'll have to be prepared to pay quite a bit more for it, we're afraid. However, this 29", ultra-wide display may be worth the extra. It has all the benefits of the previous model on this list, but offers up a much wider 2560 x 1080 display, making it over 25% wider. That means it's potentially much better for immersive gaming and movie-viewing, and comes at a pretty reasonable price considering what the rest of the market can get like. A good entry-level model, then, with a cracking discount of £125 to make it a little more convincing to the doubters.
Where to get it: Laptops Direct (**bit.ly/1Shtt6r**)

Deal 3: LG 29UC88
RRP: £480 / Deal Price: £369

Another 29" monitor with a 2560 x 1080 resolution, this IPS screen is colour calibrated with an ergonomic extra-support stand and support for FreeSync technology. Built-in speakers make it an effective all-in-one entertainment solution. It also has a huge range of extra picture modes, including split-screen, picture-in-picture and super-bright game mode. Everything you'll need out of a monitor, and the curved screen as well. What could be better for this price?
Where to get it: CCL (**bit.ly/1NafahX**)

Deal 4: AOC C3583FQ
RRP: £600 / Deal Price: £551

Another leap up the pricing scale could make you the proud owner of this 35" AOC monitor, with FreeSync support, 2560 x 1080 resolution and 160Hz refresh rate. Dual HDMI (and dual DisplayPort, and DVI-D, and standard D-Sub VGA) inputs allow you to take advantage of its many input and picture features, while dual five watt speakers help you save space and get the most out of your gaming or movie-viewing.
Where to get it: Scan (**bit.ly/23xsHHM**)

Deal 5: Acer XR341CK
RRP: £720 / Deal Price: £600

It's an inch smaller than the AOC, but this 34" monitor makes up for it in quality. The ZeroFrame screen is almost seamless around the edges of the picture, and the brushed-metal stand is higher quality than almost any you've ever seen. The resolution is QHD (3440 x 1440), and you get all the other features the cheaper screens offer: dual inputs, FreeSync and more – as well as a four-port USB hub and dual 7W speakers.
Where to get it: Overclockers UK (**bit.ly/1MvNaoL**)

The Download Directory

James Hunt scours the internet for the best freeware, shareware and paid-for application releases

This month, The Download Directory's collection of offbeat and largely undiscovered applications includes: TestLimit, a stress-testing program for Windows power users; AdFender, an anti-advert tool that works even outside your browser; Recuva, a file-recovery tool from the masters at Piriform; Never 10, a Windows 10 update blocker for older versions of Windows, and LANSweeper, a network monitoring program with tonnes of cool features.

TestLimit 5.24
Release Type: Freeware
Official Site: tinyurl.com/29bfrj

Stress testing your PC is a good way to find faults and problems, whether you're worried about system resource allocation, trying to figure out if crashes are being caused by a hardware defect or just attempting to verify that you haven't been sold a duff piece of equipment. Unfortunately there's no built-in stress test program for Windows, but this application from Sysinternals – now provided by Microsoft – seems like it be a good option.

TestLimit is console-based, so you'll have to use Windows' built-in task manager to see how it's affecting your system. That's not ideal, but it's also a good way for the program to minimise its own impact and concentrate on testing how things work. It's a shame for users not familiar with the console, of which we imagine there are increasing numbers of, but it's also important for power users who want to create automated scripts.

Make no mistake, this is a tool for power users. Far from simply thrashing the CPU like many stress-testers might, this one lets you get very specific, allowing you to do things like tie up huge amounts of RAM to see how programs perform in a low-RAM environment. You can do things like simulate a memory leak to watch your PC gradually grind to a halt, which allows you to monitor memory management.

The program automatically frees up anything it's allocated once you close it, so in theory it's easy to return your system to the state it was in, but it's worth being careful – data loss or even hardware damage could occur if you have to perform a hard reset, for example. That's just one of the things that makes this a program not suited for beginners.

Ultimately, though, it's good at what it does. We highly recommend it if you're trying to find a program that gives you fine control over your system's resources. It's got to be easier than writing one yourself, and that's pretty much the best alternative for a program of this type.

Pros: Incredibly powerful with lots of fine control
Cons: Console-only interface and highly technical behaviour puts it out of reach of most users
**Rating: 4/5**

AdFender 2.10
Release Type: Freeware
Official Site: adfender.com

Online advertising is generally considered a scourge of the modern age. While it's true that, when used properly, it can support free access to content that someone, somewhere needs to get paid for, it's also true that an increasing number of sites seem to treat the content as a way of making you look at
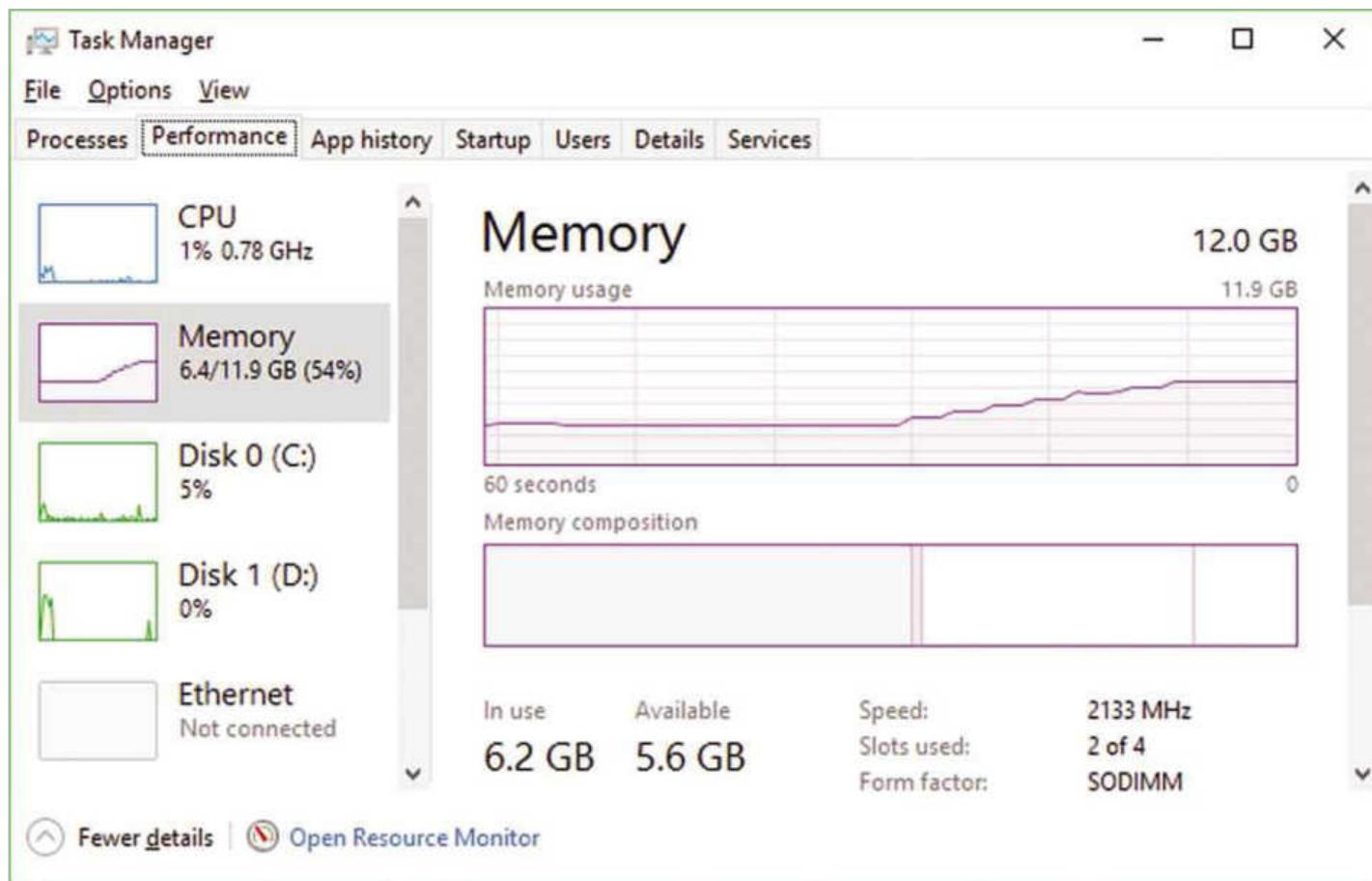
advertising. When it all gets too much, you need something to defend you from the adverts. Perhaps, some kind of Ad-fender?

Okay, so the name's stupid, but the concept is one we've seen a million times before: AdFender is an in-browser ad-blocker which can be installed at the click of a button. The way it works is by running a local HTTP proxy, which all requests are directed through. If any advert-based URLs are requested (or served) they're filtered out before they reach your browser. All very simple and transparent.

Although it's already comprehensive and useful, the software's development is definitely ongoing, which is always an encouraging sight when selecting a piece of third-party software. The latest version adds support for all kinds of new browsers, including the obscure likes of Mozilla variants Ice Dragon, Waterfox and Pale Moon. That's a level of specificity most organisations wouldn't care to mention.

Once you start using the software, the difference will be instantly apparent. Not every ad is filtered out, but the vast majority will simply vanish, and that seems like a fair exchange. Pages will load faster and look cleaner. Irritating auto-playing videos and audio become a thing of the past. On that level, it's impossible to criticise. If you're interested, you can even keep track of how well it's looking after you by checking its real-time statistics, which are updated every time it blocks an advert.

However, because the system is quite rudimentary, there are times when it can fail. It's not uncommon for site-owners to incorporate the advertising into the very fabric of their site design, and in those cases AdFender hasn't got anything built-in to compensate for removed elements. This can have a small effect, such as shuffling around a few design elements so that they look a

bit awkward, or it can render a page completely unusable. If that does cause trouble you can disable AdFender on a per-site basis, so it's not like the problem can't be solved – but then you're back to a page covered in advertising, so nor is it an ideal fix.

If you want, there's a professional version of the software that costs $20 for a year's single-PC subscription, which includes ad-blocking over HTTPS, anonymous browsing, blocking of YouTube adverts and integrated filter lists.

As ad-blockers go we've used worse, and the fact that this one works with almost any software (i.e. the local proxy can block http requests from messaging programs and applications, even within games) makes it quite powerful, but the paid version seems far too expensive and that's enough to put us off the free one as well.

Pros: A near-universal solution for banishing adverts from your online life
Cons: It's a little too blunt, sometimes, and that can negatively affect webpages
**Rating: 3/5**

Recuva 1.52 Portable
Release Type: Freeware
Official Site: www.piriform.com/recuva
Piriform are the purveyors of fine freeware of various kinds, so it's with a reasonable amount of expectation that we approach Recuva, the company's freeware utility designed to restore files that have recently been deleted, whether by you, malicious software, or some mishap such as a program crash. It is, in most ways that count, a fairly straightforward undelete program.

Recuva certainly works the same way as most of them do, restoring only the files that have been discarded by Windows
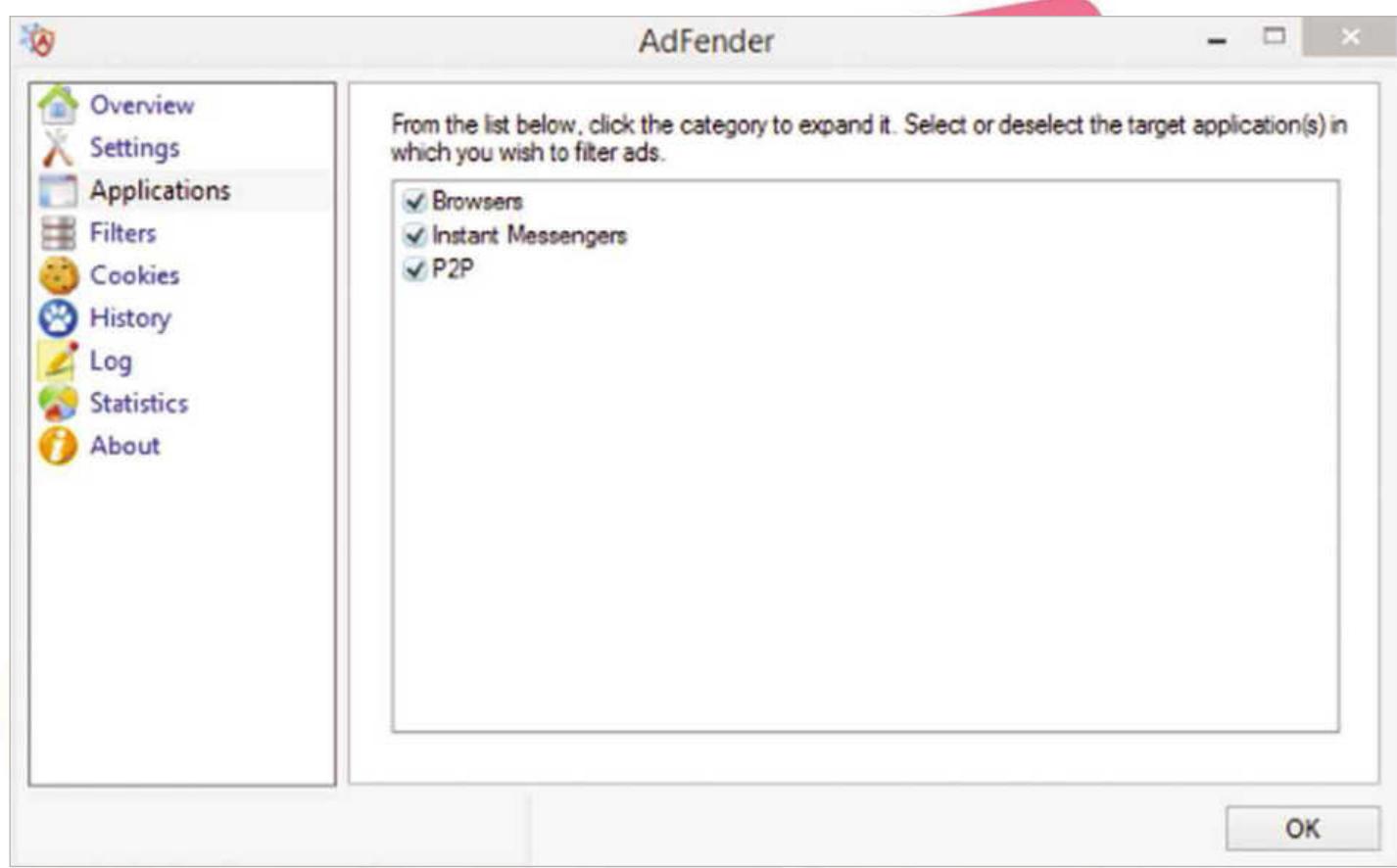
but not yet overwritten by new data, then restoring them whole-cloth whenever possible. Which is to say, not very often. To be honest, the results are not especially consistent, but that's true of almost every other undelete program. They all use the same basic mechanism, after all. Recuva doesn't distinguish itself in that regard, nor does it perform any worse than the competition, so at the very least it comes out even.

Whether or not the application is worthy of your time, must therefore lie in the nuances of its operation. Its portability means it's small and easy to download and install. When you launch it for the first time, an Undelete Wizard guides you through the process of finding and restoring the files you're looking for. With an uncomplicated interface and a lack of any particularly challenging settings, it could scarcely be less trouble to retrieve any files that haven't been completely wiped.

Unlike many undelete applications, Recuva's scans seem quick and comprehensive, and the results easy to interpret, with both basic and advanced modes. An application as simple, straightforward and well-made as this could be considered critic-proof. The only question we can ask of such common software is "is this version doing anything better or more interesting than the competition?"

Fortunately for Recuva, the answer is a solid "yes". Not so much interesting – the hand-holding wizard is about as innovative as it gets – but certainly in other areas it beats its rivals fair and square. It's free, so you don't feel as though your files are being held to ransom. It's well-made, so you don't feel like you're sacrificing quality for cost. And it should prove accessible to users of any ability, so no-one needs to feel that its powers are beyond their ability to use them.

Recuva isn't anything particularly special in terms of functionality, but it's at least as good as the alternatives and

Betawatch

To help you stay on the bleeding edge of software releases, Betawatch is a guide to the experimental and unfinished versions of some of the most popular applications around. Can't wait for new features? Now you don't have to!
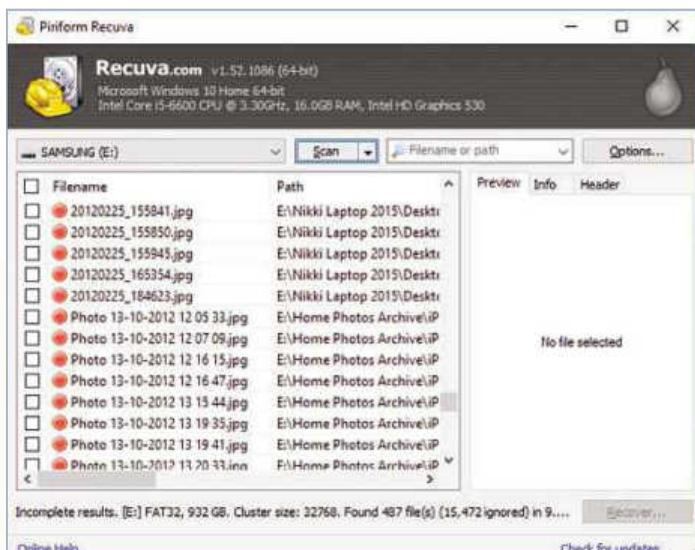
Firefox 46.0 Beta

www.mozilla.org/en-GB/firefox/channel

Firefox 46.0 was released in March, so by the time you read this it might already have had its final release. However, just in case you're still interested in the new features it contains, here's our usual list of the most interesting and/or practical changes they've made.

Perhaps the best change is the improvement in JavaScript security for the Just In Time (JIT) compiler, which has been a focus for attacks over the years. Most users probably won't notice, but improved browser security is always good for us all.

In other areas, the Content Decryption Module is now used to decode unecrypted video where available, so that should lead to faster/better video display, and there are loads of changes that have been made to the developer tool, including dominator trees in the memory tool, allocation and garbage collection profiling in the performance panel, and the ability to launch responsive mode from the style editor.

Finally, newly added HTML5 support includes new classes and HKDF support for the Web Crypto API, which gives native cryptography to any HTML5-compatible browser. As ever, you can download the latest beta client from the above URL, or switch to the beta channel to receive it automatically.

infinitely better value at the same time. That alone makes it worth shouting about.

Pros: Accessible to users of any ability.
Cons: No better at undeletion than any other undelete program.
Rating: 5/5

Never 10 1.3.0.0
Release Type: Freeware
Official Site: www.grc.com/intro.htm
Windows 10 has a lot going for it, but not everyone is thrilled about the aggressive update strategy that sees Windows badgering users to update to it. If you're the sort of person who likes to decide when, how, and indeed whether their PC actually gets updated, you're probably now having to be aggressive in your efforts to stop its advances upon your system. That's where Never 10 comes in.

The program is a relatively simply utility that you only have to run once if you want to. It doesn't actually install any files or software of its own – you just run the app and it makes a bunch of configurations for you that were previously difficult to accomplish without the use of advanced Windows editing tools, like the Group Policy Editor.

ReDownloaded
This month, in our regular retrospective section, we're looking back at the April 2014 instalment of Download Directory to see how the programs we reviewed have fared. Are they better? Worse? Gone completely? Here, we find out.

Family Tree Builder
www.myheritage.com/family tree-builder
Reviewed Version: 6.0, Current Version: 8.2.2.5
Two years ago, we were impressed by the social features and powerful online database displayed by MyHeritage's Family Tree Builder application, and since then the program has only improved, with a simpler interface and support for multiple devices with content synchronisation. The company continually updates the software and the latest version has come on a long way since we last looked at it. Seems like they're committed to the service they offer, which is always a good thing!

HWiNFO32
www.hwinfo.com
Reviewed Version: 1.4, Current Version: 5.22
It was already a stalwart on the hardware-analysis scene by the time we awarded HWiNFO32 a five-star review, we're happy to report that it's still going strong and constantly getting better. It's come on incredibly far, version-wise, but most of the updates involve adding support for new hardware and fixing small bugs more than radical overhauls, so it's still as much a must-use app as the day we first reviewed it.

Aero QLaunch
www.ck16.com/aql
Reviewed Version: 1.2.21, Current Version: n/a
Considering it was a Windows shell extender that added often garish new effects and features to Windows 7's taskbar, you might think Aero QLaunch is past it by now...And you'd be correct. The site is completely gone and we can't find another new official source for it. That's the danger in basing your software on a key Windows interface feature, we suppose. There's no way to know if and when it's going to suddenly just disappear. Hope no-one was too attached to this program as a result of us looking at it.

4Sync
4sync.com/index.jsp
Reviewed Version: 1.0.2, Current Version: 1.2.38
One of a glut of cloud-sync services launched in the wake of Dropbox's success, 4Sync was basic but occasionally unreliable, rendering it effectively unfit for purpose. These days it's looking a lot more robust, but the competition is equally strong and there's nothing that qualifies as a USP. The large capacity is the closest it comes (you can pay for a 1TB account) but in practical terms, filling it will be near-impossible, so we're not swayed. More worryingly, the client hasn't come very far either, and when we compare that to Dropbox's constant updates we're even less inclined to try it out.

Lansweeper
network inventory

search the Lansweeper database

Reporting

Dashboard reports
All available reports
Eventlog summary
Recent changes
License compliance
OS license compliance
Software overview
Department overview
User OU overview
Computer OU overview
Computer model overview
Non-active computers
Computer scanning errors
Device scanning errors

Domain overview

Domain				
Acme	164	23	0	1
Lansweeper	1	3	0	0
Subdomain	0	2	0	0
Workgroup	0	1	0	0
Total	165	29	0	1

Device overview

Fibre switch	2
Linux	2
NAS	2
Printer	9
SAN	1
Switch	2
Tape device	1
Vmware server	2
Webserver	1
Windows CE	2
Wireless Access point	3

Win XP SP2 : 3   Win XP SP3 : 161   Win 2003 SP2 : 10   Win 2003 R2 SP2 : 16
Win Vista : 1   Win 2008 SP1 : 1   Win 2008 SP2 : 1   Win 7 : 1

Space-Saving : 82   Portable : 76   Other : 20   Rack Mount : 8
Desktop : 5   Tower : 2   Docking Station : 1   Main System : 1

Dashboard reports

High priority

Error: WMI access denied (0)
Disk: Servers less than 1 GB free HD (2)
Disk: Workstations less than 1 GB free HD (1 - 0.52%)
Services: Automatic update service not running (1)
Patch: Missing patch for the conficker worm (0)
Services: Security Center service not running (165)
Services: System Restore service not running (0)

Important

Error: RPC Server unavailable (15 - 7.73%)
Computer: Not the hardware minimum requirements (1 - 0.52%)
Software: Never scanned software (1 - 0.52%)
OS: Never scanned OS (0)
Computer: Not seen in the last 30 days (194 - 100.00%)

Informational

OS: Not latest Service Pack Win2000 (0)
OS: Not latest Service Pack XP (3)
OS: Not latest Service Pack Win2003 (0)
OS: Not latest Service Pack Vista (1)
OS: Not latest Service Pack Win2008 (1)
OS: Not latest Service Pack Win2008 R2 (0)
OS: Not latest Service Pack Windows 7 (0)

Report pages

Dashboard
Software
Hardware
Server
General
Active directory
Devices

Last seen

PCSEVEN01
SUBDCWIN2008
LAN-VISTA32
LAN-LSSERVER
SUBDC1
DC2-WIN2008
SUBWIN2003-1
DOMAINDC1
DOMAINDC2
DOMAINDC3

Lansweeper.com - Premium version - Support

It could barely be simpler to use. Running the program allows you to see the exact status of your Windows 10 upgrade on both Windows 7 and 8.1, allowing you to switch it on and off. If Windows 10 files have been downloaded, you can quickly eradicate them and recover your free space. Also, if the time comes when you want to install an update – or even enable the Windows 10 upgrade – it's as simple as clicking a button.

As a freeware tool it's pretty much perfect. Whether it has huge appeal is debatable, especially since Windows 10 is currently free and much better than Windows 7 and 8. If you've got your reasons for sticking with the older versions, though, it shouldn't be for Microsoft to tell you not to.

The only minor problem is that it only works if you're using the latest version of Windows 7 or 8, since it relies on an official update that was released by Microsoft that isn't present in older versions. It might be slightly contradictory for a program based around not updating software to require the latest update, but that's how it can be so streamlined: it's not a service or background application, it's just an easy way to access a switch Microsoft has put into the operating system. We can't really fault it.

Pros: Absolutely tiny and could not be easier to use
Cons: It needs the latest update to work
Rating: 5/5

LANSweeper
Release Type: Trialware
Official Site: www.lansweeper.com

If you're running a large network, it's likely you need an auditing tool to help you monitor the hardware properly. LANSweeper arrives fully formed as the ideal choice, enabling you to scan your networked systems and get details about all of the hardware and software they have installed so that you can find rogue systems and monitor the health of a network.

If you're just running a home network, we'll say up front that this isn't anything you need. It's a highly professional tool that needs an SQL server installed so that it can manage its own database, so we're not talking about something designed for households with three PCs. That said, if you want to give it a try, the installation process can hold your hand through the addition of an SQL server to your PC, so there's no reason not to try it out.

You can access LANSweeper's stats through your browser, where it generates reports and allows you to browse its collected data. There's a 20-day trial period, during which you can get access to the full range of reports and information, but when that expires you don't lose everything and it works even as a free tool. Which is good, because even the cheapest version costs €395. Like we say, not aimed at casual use.

Once the database is built, you'll get access to any information you could possibly require at the click of your mouse, from what operating system is running to how much RAM there is available to which games have been installed. You can manually edit and annotate records to include notes and contact information, so if a particular PC is causing problems you're able to leave notes for other administrators.

There's a lot to love here, which is good considering its sky-high price. We doubt it'll be of much use to people at home, but if you work in network administration of any kind it's virtually guaranteed to be of interest. We hope it finds the people who want it.

Pros: Very comprehensive and powerful auditing
Cons: Complex setup, high price
Rating: 4/5 mm

Remembering...
3D Monster Maze

David Hayward recalls a time when dinosaurs were really scary

A few weeks ago, I fondly recalled the ZX81, a tiny computer that set many of us off on this weird and wonderful journey into hobbyist technology. This week, I'm taking a quick look at one of the most influential titles ever published on that machine: *3D Monster Maze*.

Since we're about to see the release of a new *Doom* title, it seems fitting to feature the granddaddy of all first-person games. *3D Monster Maze* took my breath away when I saw it for the first time. I had a ZX81 with a 16KB RAM pack, but all I had to play were things I created myself (getting the pound sign to move across the screen before it crashed) or one of the many educational titles that my parents bought.

3D Monster Maze was something entirely different, though. After waiting for it to load and reading through the intro, you'd finally find yourself trying to find your way around the maze before the T. rex located you and had you for breakfast. It was amazing – at least to a ten-year-old me, anyway.

After you mastered being hunted down by a dinosaur, the real challenges of *3D Monster Maze* began to surface. The ever changing maze, trying to map out each maze as you went (in case you had to redo the level), trying to keep one step of the T. rex to rack up as many points as possible and attempting to hack the BASIC portion of the game to increase its speed.

Its History

3D Monster Maze was programmed by Malcolm Evans from an idea by JK Greye, in 1981. The game was eventually finished and ready for publication early in 1982, by JK Greye Software for the ZX81 with the 16KB RAM pack.

Evans was a former aircraft designer and later a microprocessor scientist. After receiving a ZX81 for his 37th birthday from his wife Linda, Evans began to test the machine's capabilities and focused on developing a routine that could effectively stretch the computer to its upper limits.

Although the ZX81 was called primitive and suffered from a monochrome display, terrible keyboard and no sound, it was the foundation that Evans worked on, and he managed to create a game with a mixture of Assembly and BASIC, using randomly generated 16 x 16 square mazes.

Originally the maze was a top-down view, but Evans, having already been told that he was too old to go into software, created a new routine that generated a point of view of someone actually inside the maze.

According to legend, Evans met up with Greye at a classical guitar club in Bristol. Greye was just forming a software publishing company, and in passing Evans mentioned his maze routine. "Has it got a monster in it?" Greye askd, so Evans created the tyrannosaurus and the story

Did You Know?
- Evans also created the *Trashman* games on the Spectrum.
- The T. rex was copied from a children's book of dinosaurs.
- Evans created the graphics on graph paper, then into data and his wife typed it out in to the ZX81.
- Apparently, everyone who test-played *3D Monster Maze* got stressed as the T. rex started to hunt them, apart from Evan's wife, who simply started laughing.

around its re-animation. The rest, as they say, is history.

The Good
Intense gameplay, great problem solving and a very atmospheric game. The stuff of nightmares and the rise of 3D technology on home computers.
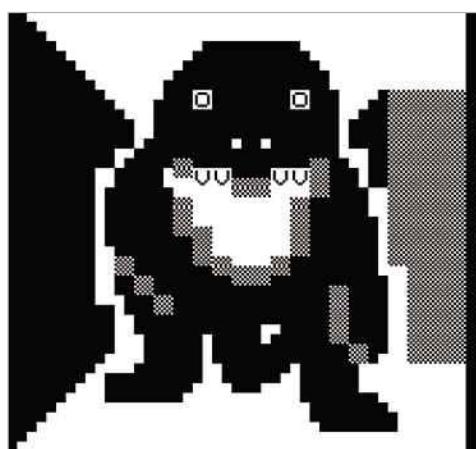
The Bad
Getting lost and getting overexcited when being chased the T. rex and knocking the 16KB expansion block to crash the ZX81.
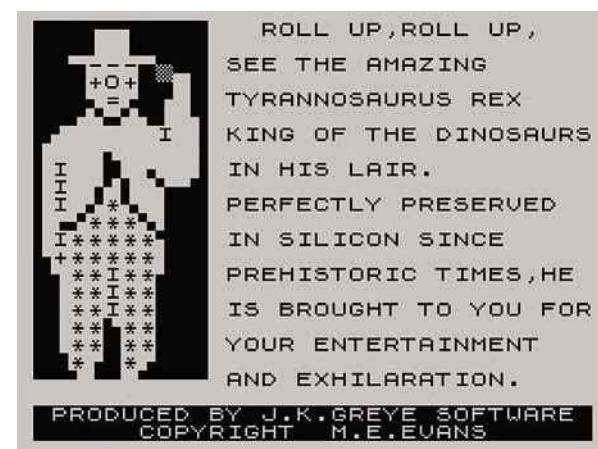
Conclusion
A wonderful game and one we'll fondly remember forever. Thank you, Malcolm.
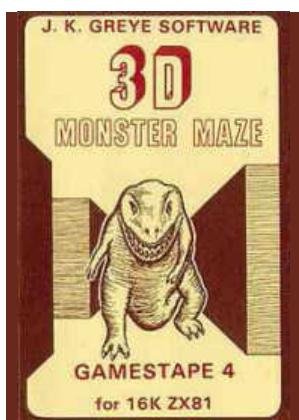
▲ *Despite the basic-looking tape cover, the game was a technical marvel*

▲ *Who hasn't panicked at seeing this?*

▲ *There's even something sinister about the ringmaster*

RETRO ROUND-UP

Dave Edwards, the man whose life is retro, fires up another selection of brand new games on obscure, and not-so-obscure, formats… Including a first for the column in the form of a retro PC title

Welcome to another Retro Round-up, where I take a wander around cyberspace looking for the best (and occasionally worst) of the newly-released games for the formats of yesterday. This month, we have, in my opinion, one of the most interesting selections yet – as the games featured all, to a greater or lesser extent, converge the modern with the retro.

Frogger we all know, but how many of us would expect a MAME-quality conversion on the humble BBC Micro? *Gamex 2* is one of the first ZX Vega-specific titles to appear. *Save The Trees* plays like a modern day budget game and *Exile 2: The Nameless* is a current PC sequel to one of the most revered graphic adventures in retro gaming history. As

per usual, visit the tinyUrls next to the game title for more information and/or to download the game – all those mentioned this issue are available free of charge.

> ## Looking at it in action, it's barely discernible from its arcade machine equivalent

Frogger
**(Retro Software, BBC Model B, Free, tinyurl.com/j7wzmrw)**
Retro Software, which publishes games for the 1980's BBC Micro machines, has announced the release of a new version of *Frogger*, the unique selling point of this version being how closely it adheres to the arcade original.

Obviously the BBC received its fair share of *Frogger* clones back in its heyday, not least of which the excellent *Hopper* by Acornsoft. So, at first sight, it seems an odd choice for a 'new' homebrew game, because there really wasn't any demand for it.

However, to approach reviewing it in that sort of way would miss the point, for it is not the game itself which holds so much fascination here.

Firstly, it is written by master Beeb coder Richard Broadhurst and, like David Boddie's *Castle Raider* (See *MM* #1350), it is a technical marvel. Why? Well, the BBC was limited in its high resolution mode to four colours. Will any games for the BBC that have more than four colours in that mode, please step forward? No takers? Not surprising, as it appeared to be technically impossible to

▲ *Frogger: A nice Mode 7 loader*

▲ *It's a Beeb of many colours*
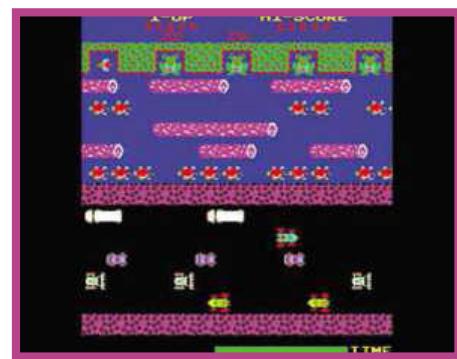
▲ *Eat the dragonfly for a bonus.*

⌃ *Hot off the press: Gamex 2*

⌃ *A cameo appearance from Egghead*

⌃ *A Bomberman clone*

⌃ *Achieving a goal*
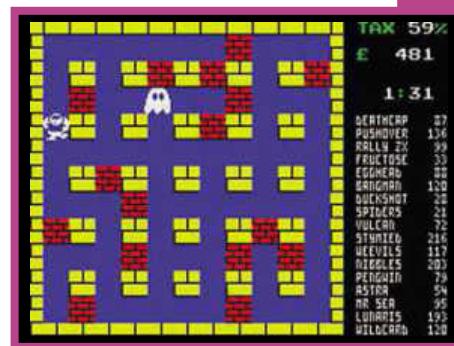
do it – until this version of *Frogger* came along, that is.

Looking at it in action (see screenshots), it's barely discernible from its arcade machine equivalent. From the jangly background tunes through the smoothly hopping frog to the identical 'snug fit' of the final leap for home, it's breath-taking to appreciate the entire game is going on in addition to poking the BBC's graphics chip in such a way as to throw out colours and definition it was never intended, or expected, to. No doubt a project of epic proportions for the programmer, the finished game succeeds in looking nothing short of effortless.

Obviously, everyone knows how to play *Frogger* too, which can't hurt when it comes to acctracting an audience. These two factors alone make it well worth a little bit of attention from anyone interested in the BBC Micro.

Frogger
Graphics 50%
Sound 60%
Playability 65%
Technical Achievement 100%
Overall 69%

Gamex 2: Playing Dividends
Graphics 68%
Sound 34%
Playability 66%
Overall 56%

Gamex 2: Playing Dividends
(ZX Vega, Jonathan Cauldwell, Free, tinyurl.com/zqtbovz)
Rather incredibly, it's nearly eight years since the first release of *Gamex: The Games Exchange*, an interesting 'compilation' idea by Jonathan Cauldwell that featured sixteen short, simple games. *Gamex 2* is more of the same – that is, different games but the same idea.

You start the game with no money, playing a game called *Deathcap*. Fling all the mushrooms out of the playing area

> **66** Gamex 2 is currently only available for the ZX Vega, but it didn't come preloaded **99**

of *Deathcap* to build up your score, in the form of pounds, whilst avoiding the patrolling nasty and his bullets. Collisions will see the 'tax percent' meter rise. When this hits 100% your *Gamex 2* game is over.

Again there are sixteen "simple" games included, all of which are coded in machine code and are very responsive to joystick/keyboard control. Amongst them a cameo appearance by Egghead plus clones of *Push The Bales*, *Thrust*, *Duck-Shoot*, *Skramble* and *Caterpillar*.

The games all use the same controls and are so easy to play that they don't really require instructions. A nice feature is that the games themselves change too. I don't know if some clever coding generates elements of them pseudo-randomly or whether they choose from several different layouts but the effect is that you're never playing exactly the same game twice.

This is important, because the skill of the game is in trading shares. Like the first one, you use the £s accumulated to buy

shares in other games and share prices fluxuate, so that when the dividends are paid on the games that you own your £s increase and you must play that game a second, or third, etc, time. Oh, and there's no escape from a game once it's started other than to complete it. So if you can't face another game of *Deathcap*, you'd better junk all your shares in it or you'll risk being forced to play it again.

Personally, I wonder if anyone really plays the trading part? My interest primarily was in seeing each of the games and, after I did, I just played the ones that I liked until I had collided with the bad guys so many times that the tax rate hit 100%. I deliberately didn't read my review of the first game again before writing about the second, in case that prejudiced what I would write. However, I suspect I probably thought the same about the first *Gamex* too.

Rather unusually, *Gamex 2* is currently only available for the ZX Vega, but it didn't come preloaded with the system. So, to play it, you need to download it from the ZX Vega forums, stick in on an SD card, plus the SD card into your ZX Vega and then access it from the on-screen menu. A Spectrum version is promised soon however, and may be published physically on cassette by Cronosoft.

Save The Trees
(Spectrum 48K/128K, Mezei Robert, Free, tinyurl.com/houg7vx)

We haven't looked at a new puzzle game on the Spectrum for a while, so Mezei Robert's *Save The Trees* is a more-than-welcome release. It's a succession of grid-based puzzles, which are not played against the clock but which steadily get more difficult.

It's simple enough to play – you have a 5 x 5 grid (so 25 squares in all) and the object is to turn any squares within that grid that are not white to white. If you believe the instructions, the grid itself is a tree and the squares that are not white are infected by grubs.

The catch is that you can only disinfect an area of either 2 x 2, 2 x 3 or 3 x 3 squares, and each screen starts with different degrees of infection affecting an ever increasing number of squares.

The squares cycle from blue (most severe), through to white (disinfected). Put simply, what you don't want to do is to spray an area that ends up leaving one infected square jutting out with only white squares around it. You can't disinfect any area that includes even a single white square, so if that happens, you've definitely made a mistake and you'll need to undo that move – and possibly previously-made moves too. The puzzle is that you don't have unlimited moves, and undoing a move also counts as one; the game is allocates you a maximum number of moves per screen, which helps to distinguish *Save The Trees* from a sort of simplified version of *Mah Jong*, as it demands a bit more thought before any moves are actually made.

Whether because I am a genius or just lucky, I managed to disinfect the first ten levels without a lot of brain-strain. After that, well, they got an awful lot tougher to figure out.

As I said, it's simple enough to play and it's fairly polished, with a loading screen and an auditory welcome supplied by one-channel beep music. However, I did think the colours indicating levels of infestation were somewhat ill-chosen – the Spectrum can actually apply a shade to each of its colours, so it seems like it would be inherently more logical to have colours 'heat up' to show levels of infestation – i.e. dull white, light white, dull yellow, bright yellow, dull red then bright red – instead of white, yellow, cyan, purple, red then blue! It's not exactly a sequence of colour that is easily memorable.

> ## 66 Save The Trees won't ever be known as one of the Spectrum's greatest puzzlers 99

A great feature is that, when you are finally defeated, you can choose to start at the level that beat you rather than having to play through all preceding ones again. However, I found the menu that allows this a bit confusing to use. You have to crank up a 'Set Level' to the 'Maximum' before then starting the game in the normal way. Less than intuitive. Also, as the game is written by Hungarian Mezei Robert, its instruction manual could also do with a complete rewrite in order to make a few things clearer. .

Save The Trees won't ever be known as one of the Spectrum's greatest puzzlers, but if you like simple but taxing games, you won't go far wrong here.

Retro Find Of The Month
Exile 2: The Nameless
(Windows PC, Ovine By Design, Free, tinyurl.com/hdnjcva)

This is a first for this column – a review of a PC retro game! *Exile 2: The Nameless* comes from Ovine By Design, and is written in large part by Trevor Storey, who brought us Darkness (C64, Psytronik, see *MM* #1346) and Soulless (C64, Psytronik, *MM* #1350). It's prefixed '*Exile 2:*' because it's a similar adventure to the classic *Exile* by P. J. Irvin and Jeremy Smith. (If you haven't heard of the original, then visit **tinyurl. com/zcsnkea** for more!)

There's an atmospheric, short manual in which you learn *Exile 2: The Nameless* will cast you in the role of a space trader travelling an area of space called 'The Rim'. Running low on fuel, he descends into orbit around the planet Mars – which, at least in this game, is an inhabited, terraformed planet. However, although inhabited, it seems eerily deserted when he arrives. Those are the only instructions you're given, which, as a concept, is also identical to the how the original *Exile* played out. Almost everything about the planet is left for you to discover yourself.
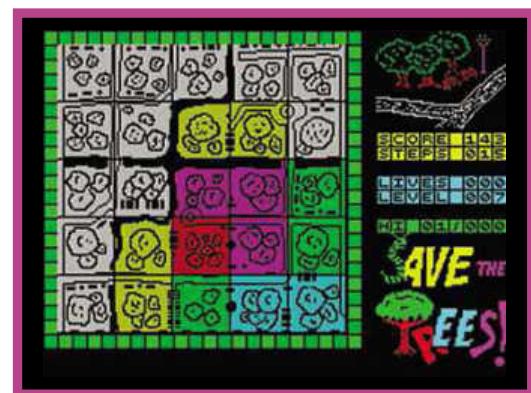
It is viewed side-on, a platformer/graphic adventure, with your spaceman kept in the centre of the screen. The controls - keyboard only - are overhauled
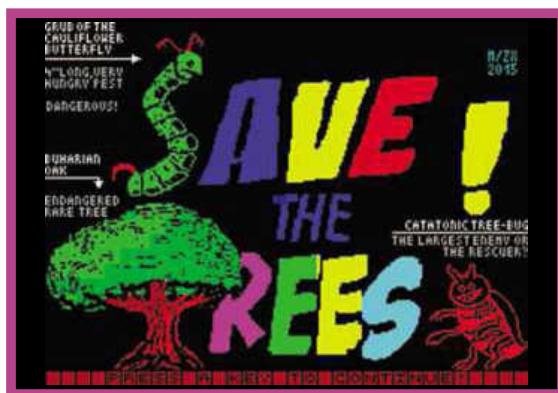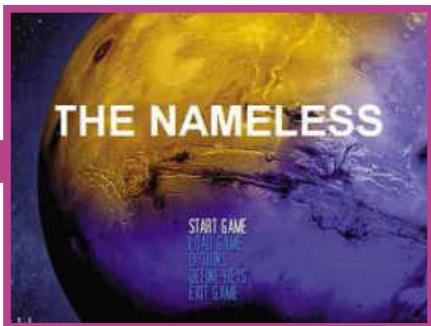

⌃ *The cover art for the cassette version*

⌃ *Loading… please wait…*

⌃ *Select an area then remove it*

▲ *The planet Mars – you don't like it*

▲ *The big wheel is where you'll teleport to*

▲ *Descending through the first keycard door*

from the 20+ keys you needed to learn in the original, and you start off with a gun and an infinite supply of jetpack energy too. The R to Remember your location and T to Teleport there has also been retained.

Graphically and aurally, it's much more eerie than those acquainted with *Exile* might imagine. Collide with Martian statues and you'll hear mysterious whispering; in control rooms, overheard muffled radio conversations give an indication that there are others alive elsewhere... Although why do I suspect that, when you find them, it's not going to be a case of asking them for some fuel and being able to say goodbye?

There are three big irks that seasoned *Exile* players will detest about this sequel, however. The first is that the spaceman moves differently in this game. He doesn't perfectly flip and twirl as he did in the first part. What made the original so great was that the mass of the characters corresponded perfectly with your expectation of what would happen during collisions in relation to their size and proportion.

However, in *The Nameless*, the small annoying birds that beat against the spaceman can not only push him back; they can also pick him up and cast him miles across deep space. Secondly, the simplification of the gun controls reduces a lot of the dexterity of combat, which was also a feature of the original. In *The Nameless*, you fire in the direction you are facing, at one of eight angles. For example, blast north-west and fire your pistol and the bullet streams north-west. In the original, you could aim your gun at any angle, meaning if an enemy ducked out of your line of fire, it wasn't necessary to completely re-orientate your spaceman to line said enemy up again. You could

adjust your aim whilst continuing to fly in whatever direction you wished.

I found that I did quickly get used to simply flying around with the new controls. They're different, but easy to master. Yet, when I needed to fire, or solve a puzzle using items I'd collected, the mechanics were so different that I ached for the dexterity of the original game.

The second irk comes to relation to teleporting. As in the original, you have a massive area to traverse and, to help you, you can set up to four teleportation points. A simple tap of key T will then whisk you out of danger and back to the most recently remembered point on the

> **66 When I needed to fire, or solve a puzzle using items I'd collected, the mechanics were so different that I ached for the dexterity of the original game 99**

map. The fifth teleportation point is always the safety of your ship.

Also like in the original *Exile*, you can't die and if you are losing energy quickly you will automatically teleport. But - and this is a huge but - in the original, the automatic teleport took you to your most recently remembered point, just as if you pressed T. In *The Nameless*, automatic teleportation takes you all the way back to your ship! I have no idea who thought this would be a good feature/upgrade over the original method. It really isn't. If it ain't broke... As they say.

A big plus point of *The Nameless*, however, is that it features text. Scattered around the planet you'll find terminals that you gain access to by using the Fire

key. The one that's reporting missing crew members on the deserted planet seems a particularly immersive plot device. I should also make the point too that fans have often decried the fact that its hero only had the one adventure. The differences highlighted don't distract so much as to mean that you can't consider this very much a game of the same type. Mass, inertia, thrust, gun droids and grenades are all here, even if dealing with them feels different.

Ovine By Design has a large catalogue of retro remakes and retro-inspired games, all of which, including *Exile 2: The Nameless* can be downloaded and enjoyed completely free. If the rest of the catalogue is as impressive as this, then we should probably head on over to the site and get them all!

That's All Folks!

I don't know how many of you follow the TinyURLs for the games reviewed in Retro Round-up, but if you haven't yet seen the site *EveryGameGoing*, you are currently missing out on watching the development of the biggest retro gaming resource in living memory. You just read four reviews but – at time of writing – *EveryGameGoing* currently holds over 23,000 more of them, including over 400 video reviews.

Don't be shy, come on in! You can find the site and all that content at (unsurprisingly) **www.everygamegoing.com**. See you next month! **mm**

Exile 2: The Nameless
Graphics 82%
Sound 67%
Playability 76%
Overall 75%
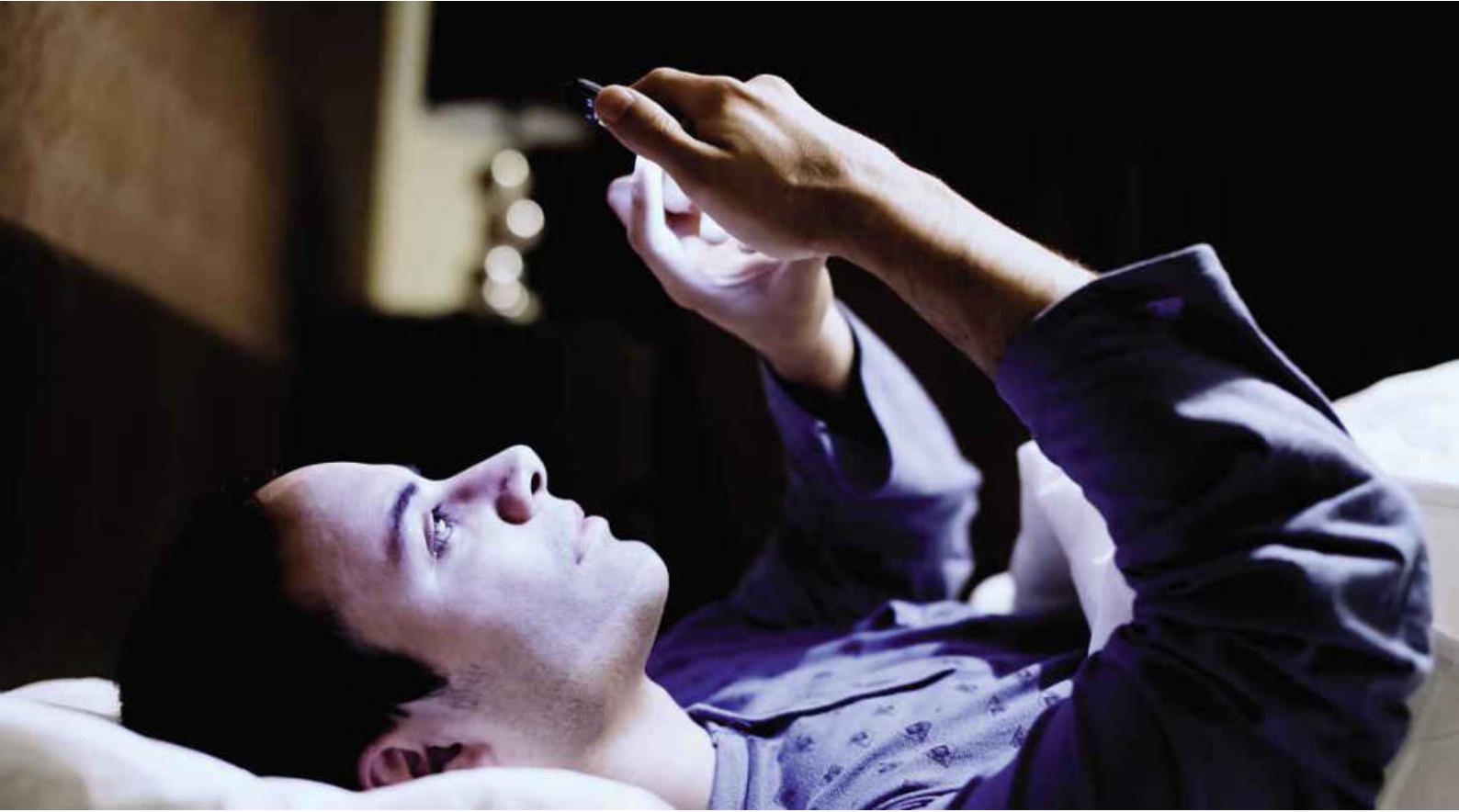
Technology That Can Help You Sleep

We all know modern gadgets can keep you awake at night, but they can also be used for the exact opposite reason

If you've ever found yourself engrossed in a good book at 2am on a work night, then you'll know how reading can keep you awake instead of helping you nod off. But these days, thanks to e-readers, even the most dull or badly written of prose can prevent you from getting a good night's sleep.

The problem, as you likely already know, is blue light. As numerous studies and researchers have shown, the short wavelength light that is emitted by our smartphones, televisions, e-readers and so on tells our brains that it's not time to sleep. The 'circadian rhythms' that determine our internal clocks are messed with, and the production of the sleep-inducing hormone melatonin are suppressed. The result is plenty of tossing and turning, and not a lot of good-quality shut-eye.

That's why experts recommend limiting exposure to blue light at least 90 minutes before you intend to sleep. Putting away your phone and laptop and not watching TV would help, of course, but it's not that simple, unfortunately. There's also evidence that room light from ceiling fixtures and lamps produce enough blue light to keep you awake too, especially as we move away from incandescent bulbs towards LED lighting (**goo.gl/fBXtG**).

Bearing this in mind, completely eliminating blue light an hour and a half before you sleep is going to be difficult without sitting or lying in a completely darkened room. That's not necessarily a bad idea, but if you'd rather spend the last few hours of each day doing something else, then there are other solutions, many of them technological. Yes, plenty of technology might keep you awake at night, but as we'll see, there are also a fair few ways it can help you instead.

Blue Light Filtering Software

If you're not prepared to give up your gadgets, then you can do your eyes and your body clock a favour by installing a blue light filtering app on your smartphone or tablet. There are plenty available from all the major app stores, but one of the best is F.lux. Available for iOS (jailbroken), Android, Linux, Mac OS X and Windows, it changes the colour balance of your device's screen, reducing the amount of blue light that is emitted, thereby helping you to sleep.

But it doesn't stop there. Although you can toggle the filter on and off, you can also adjust the strength of the filtering effect and, best of all, F.lux can be set to automatically adjust the colour balance

▲ *F.lux*

▲ *A simple pillow speaker*

▲ *One pair of many tinted glasses found on Amazon*

according to the time of day and whatever time you tell it you wake up normally. There are even options to allow for weekend lie-ins, extended daytime hours and extra sleep for teenagers.

Other apps and programs worth checking out include Blue Light Filter For Eye Care, Redshift, Twilight and Screen Filter.

You might also find that your device already has a blue light filter built in. Apple, Google and Amazon have all recently added this functionality, for example, as have some monitor manufacturers.

Blue Light Filtering Hardware

Using software to limit exposure to blue light is all well and good, but what about for devices that don't run apps? How do you protect yourself from the light emitted by your e-reader, TV or 'feature' phone.

The answer is with a special screen protector. These are available from numerous companies, including Ocushield and OptiGuard, among many others, and they can be placed over a wide range of devices.

The big question, though, is whether they actually work. This is open to debate, because many such products appear to be completely transparent and don't affect the colour of the screen they're placed on. If they're blocking blue light, then it figures that the colours you'd see through them would be altered.

Indeed, there are also screen protectors that give screens a yellow tint, like those at **www.sleepzzz.ca/screen-filter** and **www. lowbluelights.com**. In fact, the latter is fairly unequivocal in its feelings towards more transparent filters:

"We've tested most of our competitors' so called blue-blocking filters, many that use PET films such as the SleepShield, and have found that these filters block only a minute amount of blue light – certainly not enough to prevent melatonin suppression. Many companies are falsely advertising that their products do not change
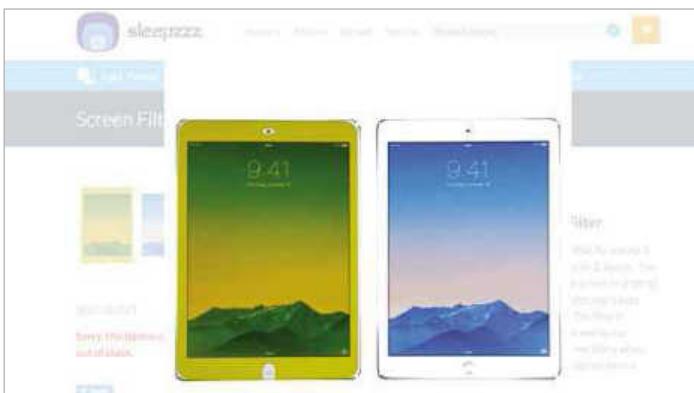
▲ *More effective filtering?*

the screen appearance and yet are supposedly blocking blue light. We guarantee that if blue light is visible, then it's certainly not being blocked. Beware. You can't block blue light and see it too."

Whatever the case, putting plastic filters on your screens isn't ideal, because not only do you need to get one for every screen you use, you also need be able to get them made in the right sizes. Apple devices are well supported, but other products aren't always as well catered for. Some companies even offer custom sizes, but it's still extra hassle.

A solution that eliminates this problem is blue-light-filtering spectacles. Opticians now offer this as an option on their lenses, but you don't need to visit a specialist to take advantage of this idea. There are plenty of non-prescription filtering glasses available online. Some of them are marketed specifically as blue-light-filtering glasses, but many of them are just yellow- or orange-tinted sunglasses. So as well as being able to get to sleep more easily, you'll also get to look like a rock star.

Special Bulbs

As with the other hardware we've covered, there are companies that specialise in low-blue-light bulbs and lamps, LowBlueLights.com being one of them, as well as special bulbs from firms like General Electric (**goo.gl/lqJjca**).

For bedside lamps, you could just use ordinary cheap orange light bulbs, because you only tend to use these when you want to sleep anyway, but this is still a limited solution, because the only way to get a different form of light is to change the bulb.

Thankfully, there are more elegant solutions available, but they're naturally pricier. For example, you can get the Drift Light (**drift-light.com**) for around £20. This LED bulb can be used like any other light bulb, but if you flick the light switch twice in succession, it will change to a mode that mimics a sunset, slowly dimming over a period of minutes. It also has a nightlight mode.

The Drift Light isn't a hugely original idea, though, having been used in other products, such as the Lumie Bodyclock range of alarm clocks. These clocks geared more towards waking you up slowly rather than helping you

▶ *The Drift Light*

▲ *One of the Sleep Genius sets*

▲ *Beddit – a potentially more accurate sleep tracker*

sleep, but they do have a sunset function too. Starting from around £60, though, they're considerably more expensive than the Drift Light.

You could also consider one of the many smart bulbs that are now available. These tend to be expensive, but unlike the Drift Light, bulbs like the Philips Hue series (**www2.meethue.com**) can be controlled using mobile apps, and they offer a far more versatile solution. They're not necessarily designed specifically with sleeping in mind, but their smart features make that possible. Plus you get to impress your mates by switching the lights off from a different room.

Relaxation Apps

Even if you've completely eliminated all blue light from your bedtime routine, you might still find it hard to get to sleep. Sleeping pills are an effective but drastic option, and cups of camomile tea are more likely to see you getting up to empty your bladder, rather than helping you doze off.

This is where relaxation apps come in. Most of them simply offer looped audio of sounds that many people would find soothing: bubbling brooks, small birds tweeting (as opposed to giant seagulls squawking), gentle waves and so on. Some also feature calming music to help carry you off to your slumber. There are loads of these to choose from, with names like Sleepy Sounds, Nature Sounds Relax and Sleep, Relax Melodies, and Sleepmaker Rain. Most of them are free, though, so you can just try out as many as you can to find one that suits you. A more expensive option is Sleep Genius (**sleepgenius.com**). Although it's free for Android (including Samsung's Gear wearables), the iOS version costs £3.99, and both are linked closely with the firm's hardware sets. These come with an iPod Shuffle and either a speaker or a set of SleepPhones (earphones built into a headband).

Another approach that might appeal to insomniacs is to use a deep breathing app. Whether it's Breathe2Relax (iOS and Android) or something like Long Deep Breathing (iOS), these will walk you through breathing exercises that could help you relax and, of course, sleep. It's questionable whether such apps offer anything that you couldn't get from a book or website, but if they work for you, then they're undoubtedly worthwhile.

Sleep Tracking

Rather than helping you get to doze off, sleep tracking apps and hardware monitor your sleep cycle, watching you to see when you're sleeping soundly and when you're restless. The apps tend to your phone's accelerometer to track movement, but you can also find the same technology in smart watches and fitness trackers, along with other technologies that make them more accurate, such as sensors for heartbeat, light level, sound and body temperature.

The data you get from these could be used to come up with a more effective bedtime routine, but that's not the only use for it.

Many sleep trackers can also be set to wake you up only when you're in the lightest phase of sleep, which is meant to leave you feeling more energised.

Just being able to how much sleep you're getting is useful, but the limitations of movement-based sleep tracking are obvious. Just because you're still, it doesn't necessarily mean you're comfortable or breathing well. That's worth bearing in mind if you use smartphone apps to track your sleep. That's not to say they can't be helpful, but you're always going to be better off using a hardware solution like the Beddit Sleep Tracker (**www.beddit.com**) or a smartwatch.

You might also like to consider a special bed base like BeautyRest's SmartMotion bases (**www.beautyrest.com/Smartmotion**), which work with the company's SleepTracker app to monitor your sleep and ensure you get a good night's rest. At least that's the theory. Does it work? Maybe, but you'll have to pay at least US$1,199 to find out.

Bedphones And Sleep Pillows

Whether you're using a sleep sounds app or listening to Wham's greatest hits to get the sandman to work his magic, if you share the bed with another person, they either need to share your love of 'Club Tropicana' or you need to wear headphones.

If you sleep on your side, an ordinary pair of over-ear headphones are out of the question. And even if you don't, if you fall asleep with them on, they're likely to be restricting when you inevitably move around throughout the night.

In-ear headphones might be a bit more comfortable, but they're still not ideal. Also, if you're anything like us, then you'll be enormously paranoid about the possibility of being strangled to death by the cord (something that has probably never happened in the entire history of earhones).

Bedphones, as worn by someone pretending to be asleep

Although they're wired and therefore don't address our death-by-headphones fear, Bedphones (**www.bedphones.com**) promise to be so comfortable that they won't disturb you when you go to bed. It's certainly an intriguing idea, but they appear to be little more than fairly standard clip-on headphones, although they're much slimmer than normal. The few user and press reviews we could find were mixed, but more of a problem is actually finding a retailer that's still selling Bedphones. Both Amazon and Tesco, for example, did have them in stock once, but they don't sell them anymore, and Google Shopping returns no results either.

Searching for 'bedphones' in Amazon does, however, come back with various other sleep headphones, but ones built into headbands. These are all from different companies, but they're all cheap, and they all have mixed reviews. For around £12, though, they're probably worth a punt if you have trouble getting to sleep. Most of them have wires, but if you're prepared to pay a bit more, then you'll also find there are Bluetooth models available as well (this one, for example: **goo.gl/VwJ99G**).

If you just don't want to wear anything on your head, though, none of these will be helpful. In that case, you might be more interested in a speaker pillow. As you can guess from the name, this is just a pillow with a speaker inside it. The idea is that the person who has their ear on the pillow, in close proximity to the speaker, can hear their music or whatever, while others in the room won't hear anything. Brands include Sound Pillow (**www.soundpillow.com**) and Sound Asleep (**www.soundasleeppillow.co.uk**), but there are plenty more manufacturers, and prices start from as little as £7.

Of course, you might be perfectly happy with your current pillow, but that doesn't mean you get left out. You can also buy speakers designed to be placed under your pillow (or even inside it, if you don't mind doing a bit of sewing). For example, you can get a simple pillow speaker from Amazon for just £1.62 (**goo.gl/z8EdVi**), at time of writing, and even though that's unusually cheap, most other pillow speakers don't come in at more than £10. That's not surprising, considering they're simple mono units, probably costing pennies to make.

Will Any Of These Actually Work?

As we've already seen, there is some science behind many of these products and apps, but whether they actually help you is always going to be largely a personal thing. If you're being kept awake by stress,

The Sound Asleep pillow

➤ *Most sleep headphones are fitted into a headband. This set here also has Bluetooth*

then all the orange lamps and blue-light filtering in the world isn't going to provide any relief, but apps and hardware that help you relax might actually do the trick.

It's also worth considering that the things you do to help you sleep might actually be having the opposite effect. We already know that reading an e-book can be counter productive if your e-reader emits light, but that's not the only thing that could be less than helpful. You might think that listening to music relaxes you, but like an addictive novel, it also has the potential to invigorate you. Any kind of mental stimulation can do that, so even if this (or, indeed, something else) is part of your nighttime router, don't be afraid to change things to find what's actually right for you.

Hopefully, with the right mixture of reduced screen time and relaxation, you can stop yourself from suffering sleepless nights. And, as we've shown, technology really can be part of the solution, rather than just being the problem. Sweet dreams. **mm**

A Big Green Fly In The Ointment

Much is made of the problems caused by blue light. Indeed, it's been referred to several times in this very article. But it's not the only type of light we need to worry about. There's also evidence(from Harvard, no less: **goo.gl/snt79S**) that green light can mess with the body's circadian rhythms too, which is problematic, because many filtering products are focused only on blocking blue light.

According to a blog post on the Polyphasic Society website (**goo.gl/H8Okby**):

"There are a lot of 'blue blocking' products out there that use amber or orange coloured devices. While amber lensing may be more practical in some cases for night vision, red coloured products will be much more effective for one reason. Research shows that green light also blocks melatonin production, perhaps as much as blue light. Amber and orange coloured lenses may block blue light but not block green spectrum light, while red coloured protection will block both green and blue."

So there you have it. If you really want stop your devices from keeping you awake, you should be using red not orange filters.

Your Letters

Security Gone In A Flash

It has been revealed that there is another vulnerability in Adobe Flash, together with some active exploits attempting to use that to attack users' computers. Adobe have speedily released an update for Flash that fixes the problem. This is applicable to most browsers – but not Internet Explorer. At the time of writing (Sunday 10th April), Microsoft have not released any patch or update for IE as yet, apparently waiting until Patch/Update Tuesday (Tuesday 12th April, US time) before solving the security issue. That is deplorable for any organisation, leaving millions of customers at risk for no good reason at all. Most Windows systems prior to W10 have to have IE present as it forms part of the operating system. Are Microsoft assuming that 'everyone' now uses W10 with Edge? It appears there are millions not using W10 yet and many who do are not using Edge at present. So everyone with a Windows system is being left vulnerable for no good reason.

Shame on you, Microsoft.

Michael Perry

In Defence Of Cable

As a regular reader of your magazine I very much appreciate the technical scope and accuracy of your normal articles.

However, in the 31st March to 6th April edition I was somewhat taken aback by the article on page 58, 'When cable comes to town'.

While the introduction sets out the aim of the government getting the fastest broadband possible to all corners of the UK as soon as possible, the remainder of the article ends up as a personal diatribe about the 'mess' and disruption that the village has suffered during its installation.

As someone who commutes just under 100 miles every day and, for the last three months, has had a ten-mile detour down minor country lanes full of HGVs forced upon me. I do have some sympathy. This detour, though, has been in order that the village closest to my place of work (an airfield) gets a new water main. In that they really do have my sympathy. However, like your writer, no one asked my opinion before they started.

Unfortunately, what I began to read as an update on the technology of broadband told me more about the character of the writer that the subject of broadband provision. 'NIMBY' comes across quite loudly. He/she starts by criticising BT and its Openreach for not allowing other providers access to its system and then complains, in minute detail, as to how the competition (Virgin) is making a mess because they're having to create their own access.

At least Virgin is laying cable to each address. Openreach only goes to the 'nearest' exchange and then you are left with the bottleneck of copper cable from the exchange to you. Depending on the length of copper then determines your ultimate speed.

Your writer complains that no one canvassed whether the village wanted broadband through this means. The government has taken the line that it should be available to everyone. I suppose if they had been canvassed, that if a minority of members in the community did want the opportunity, then the majority could stop them if they so wished? How about the person who may wish to buy his house in the future? Might he not want broadband right to his door?

As I say, I now know more about your writer than I do know about the improvements to broadband.

I do hope that you didn't spend too much when you paid him/her?

AJ Pring

Windows 10

Mark Pickavance is off on one about Windows 10 again. Can I ask a simple question? Can you choose to run an older version of Android, Apple OS or even Linux? I don't think you can. If you install any of these operating systems, they will automatically keep your system up to date. You choose to run Windows (an operating system), you have to put up with the latest version or use another operating system. We have to stop thinking of older versions of Windows as separate operating systems.

Ross Paton

GET IN TOUCH...

Alphabet Pi: G

David Briddock meanders through Raspberry Pi technology from A to Z

THIS WEEK: GPIO, Geany, GTK+ and Games

GPIO

The Pi's GPIO connector is a General Purpose Input-Output interface. With both 3.3V and 5V power rails plus a selection of digital data pins, it's designed to interconnect the system software and user programs with an experimental world of electronic circuitry and sensors.

The original Model B, and the subsequent Model A, had a 26-pin GPIO connector. It was arranged in a 2x13 strip and marked as 'P1' on the circuit board. Revision 2 of the Raspberry Pi Model B circuit board made a few subtle GPIO pin reassignments.

When the Model B+ appeared it had an extended 40-pin GPIO socket. However, the first 26 pins replicated the original GPIO connector for compatibility with existing add-ons boards. There's a comprehensive guide to using the GPIO on the eLinux website (**goo. gl/FbQye**). The same web page has numerous GPIO code examples in C, Python, Linux shell script and many other languages.

Python coders can download Google's useful Python package to interact with the Pi's GPIO (**goo.gl/C5LDp**).

A recent development is the GPIO Zero library, which makes coding even easier by reducing the amount of code that needs to be written.

Geany

The Geany editor (**geany.org**) is a great tool for Python coding. It's easy to set up, and the lightweight footprint means Geany runs on any Raspberry Pi model.

Unlike a simple text editor, Geany has a built-in Python syntax parser, which checks your code for syntax errors before the program runs. This parsing feature also means Geany can colour-highlight the source code.

Geany also understands many other programming languages, including C, Java and HTML.

GTK+

Originally named the GIMP Toolkit, the cross-platform GTK+ software is a set of 200-plus widgets designed specifically to build graphical user interfaces (GUIs). Its open source LGPL licence allows both free and proprietary use.

Written in the C language, GTK+ is used by Linux developers for X11 desktop systems, many Qt-based GUIs and the new Wayland GUI. But its C-based portability means it's also been compiled for other platforms, including Microsoft Windows and Mac OS X.

Games

The flexibility of the Raspberry Pi platform goes far beyond education and hardware hacking. It can be a low-cost gaming machine too, and there's a sizeable collection of Pi games to suit all kinds of gamer.

Take the first-person shooter *OpenArena* (**openarena.ws**). Anyone whose played *Quake III* will find *OpenArena* instantly familiar. In fact, it's actually a development fork from the *Quake III* source code. And anyone can get *OpenArena* for free thanks to an open-source licence.

Based on a classic, *Cuyo* is a colourful falling-blocks game where the usual shape-fitting challenges are enhanced by colour and pattern matching combinations.

In the *Penguins Puzzle* game (goo.gl/G2p4e) you have to keep

❝ The Geany editor is a great tool for Python coding ❞

your Penguin dry – something that gets harder as you progress through its 50 levels.

If you're into retro-style games, the PiPlay app (**piplay.org**) emulates the SNES, NES, Gameboy, Atari 2600, Commodore 64 and many other games consoles.

But you don't have to play a game written by someone else. Instead, why not code one yourself using the Python language and the PyGame library?

Windows Bashing

No more Bash, virtually
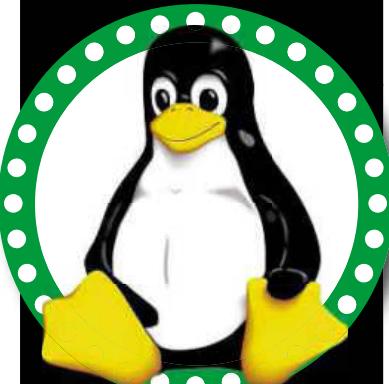
David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Linux

I have to admit, when I first heard about Windows 10 having a Bash native command line, I thought it was an elaborate April Fool's joke – even though it was a day or two beforehand. Even a week later, I was cautious about mentioning it in here or on social media. But I was wrong, and, yes, here it is: Bash on Windows 10.

You have to admit, it's like a dream at the moment. Microsoft and Linux skipping happily together over the Windows XP Tellytubby desktop, picking flowers and being all peace and love, man. While it may not be a vision from the Summer of Love, Microsoft's partnership with Canonical is creating one of the biggest news stories of the year.

Anyone who decides to sign up to the Windows 10 Insider program, by opening up the Start button, followed by Settings > Update and Security and following the Advanced options link, can download the necessary updates that will allow you to use Bash in Windows 10.

When the downloads are complete, drop into a command line and type in 'bash' to begin the installation. After that, you'll be able to run Bash scripts, Linux command line tools such as sed, awk and grep. And you can use tools such as Ruby, Git, Python and so on without the need to ever drop into a virtual environment.

It's still a beta at the moment, so there will be some rough edges. According to Microsoft, the final version will be made available to Windows 10 users in July, with the Windows 10 Anniversary Update. To quote the Bash on Windows team message post-install:

"First, this is the first time we're releasing this technology – it's marked as beta for a reason: We know that there are some rough edges and that some things will break! Do not expect every Bash script and tool that you run will work perfectly – there will be gaps. But by trying out this feature, you'll help us figure out what we need to work on in order to greatly improve our reliability, coverage and reach.

"Second, while you'll be able to run native Bash and many Linux command-line tools on Windows, it's important to note that this is a developer toolset to help you write and build all your code for all your scenarios and platforms. This is not a server platform upon which you will host websites, run server infrastructure, etc."

What Of The Future?

The news of Bash on Windows has been met with some positivity, thankfully. We all know that any community can get a little hot under the collar when something like this appears. So far we've seen comments such as "About time!", "Bash on Windows is da bomb!" and "This is great news for the community."

One poster mentioned that Microsoft should have adopted Bash on Windows instead of Powershell, and I'm tempted to agree with them on this point. Bash, in my opinion, is more friendly and easier to use than Powershell – even if Powershell is probably more powerful.

Anyway, it's all interesting news. But what do you think? And do you have anything planned for Bash on Windows? Let us know at the usual address **(letters@micromart.co.uk)**.

Until next week, folks.

▼ *It really is Bash on Windows. Whatever next?*

Baby Steps

Craig Grannell's offspring is immersed in the world of technology, but the Mac has been bypassed

There are few things in life that can make you more aware of your own obsolescence than having your very own tiny human scampering about the place. But my own experience has been to marvel at how a baby and then a toddler can pick up technology. Said observations have at times made me wonder what this all means regarding the future of Apple and the Mac.

The Mac was the first Apple technology our own tiny human was attracted to. More specifically, the keyboard very abruptly became the most amazing thing in existence. I mostly noticed this when said (then very young) child was on my lap, spotted the keyboard, quickly hammered away at loads of keys, and the on-screen windows went crazy. When I was on deadline.

But as much of an eye-opener as that moment was, I don't think anyone would kid themselves into thinking a baby was actually typing, nor had any idea what the keyboard even was. It was just a fun object to smash. Even now, as our tiny human approaches birthday number two, there's barely any understanding of how interconnected technology can be. A small hand tapping on a trackpad or keyboard to wake a Mac is about as far as things go. And the Macs themselves are very boring, because they don't have Peppa Pig scurrying about, and there's a distinct lack of *101 Dalmatians* running on a loop.

Apple, though, while always arguing there's value in the Mac, has for some time pinned much of its future on iOS. This is something I now suspect is inevitable. From 18 months or so, our toddler quickly started getting to grips with the iPhone. The big eye-opener was that randomness quickly disappeared from the various interactions. Instead, there was the kind of methodical testing that tends to happen with any toddler and a new object.

Initially, there was a lot of curious tapping within an app, and then a few swipes and drags. Very quickly, real-world skills were transferred to screen. I watched quite astonished as an entirely new Very Hungry Caterpillar mini-game was completed first time out, on the basis that it resembled a wooden puzzle lurking elsewhere in the house. Beyond that, the child realised what the home button does, both in exiting apps and cancelling accidentally activated home-screen app icon wobbling. Tiny hands became a blur of activity, moving between apps, playing with something for a bit, dismissing others (notably, anything with a splash screen lasting more than a few seconds), and thereby showcasing how important instinctive gestural input is for immediacy and ongoing interest.

That's not to say our kid won't at some point become enamoured with computers with real keyboards. Macs can do things iPads and iPhones can't, although the gap is narrowing with remarkable speed. It's also notable that many of the things long-time tech users find abhorrent about mobile (typing on glass; the lack of many-app multitasking; the means to have displays the size of a cupboard door) just aren't a problem to the younger generation. Instead, younger people prize being able to directly interact with content, true portability, and the plethora of tiny, focused apps that enable you to achieve a lot in very little time, without having to wade through screens of menus and options.

I myself will be sticking with the Mac for the long haul. I love my iPad but wouldn't be without my iMac and its large screen. However, I do suspect I'm the last generation of my family who'll think this way.

⌄ Mini-G is captivated by iOS and doesn't care about the Mac, with its lack of interactive caterpillars to feed. This is why the Mac is doomed long-term, clearly

Craig Grannell is a writer, designer, occasional musician and permanent loudmouth. He's owned Macs since 1996, when Apple was facing certain doom, and is therefore pleasantly surprised by its current success. Find **Craig** on Twitter at **@craiggrannell**

Mac

And The Winner Is....

Ian is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

It's no secret that despite being worth double the combined film and music industry revenue in 2015 ($45bn vs $91bn), video games are still given patronising coverage in the rest of the media. One organisation that has taken gaming seriously, though, is BAFTA. Since 2004, the BAFTA Games Awards have joined the traditional film and TV awards in an annual recognition of all that is great in the world of gaming. What's more, there's always been an award for mobile and handheld, and this year's selection was an interesting bunch indeed:

The Room Three – If you've played either of the preceding *Room* games, you'll be able to appreciate how well deserved this nomination is. *Myst* meets Pandora's Box is still the order of the day, though the puzzles to open up the boxes have become more intricate than before but never impossible. The atmosphere is also still a unique Edwardian take on Magick, and British developer Fireproof Games has raised the already high bar for sumptuous graphics.

Prune – As beautiful as *The Room Three*, albeit in a totally different way, *Prune* is another 'zen' kind of game, where the simple gameplay is satisfying and beautiful. The idea is simple: grow your tree to get the required number of flowers to appear in order to progress. *Prune* parts to allow others to grow towards the life-giving light and avoid red globes. Think of it like a relaxing **Fruit Ninja**.

Alphabear – Ludicrously gorgeous game involving collectable bears and words. It's a bit like *Threes* except you make words that disappear to make your bear bigger. The bigger the word, the bigger the bear and the bigger the points. Difficult to explain but easy to play, it's the beautiful cartoon design of *Alphabear* that draws you in until the gameplay has you hooked.

Fallout Shelter – *Fallout 4* may not have been quite as universally loved as *Fallout 3*, but its little pre-release freebie *Fallout Shelter* certainly found favour with some. Not that it was an original game: you build a Vault-Tec vault for your survivors to keep them happy post-nuclear holocaust in a *Sims* / *Theme Hotel* type way, adding rooms, character missions and more, all keeping in the *Fallout* style but in a mobile friendly format.

Lara Croft Go – Take *Hitman Go*'s innovative turn-based take on the action genre and swap the bald man for a tomb raider and action for adventure, and you get *Lara Croft Go*. Like *Hitman Go*, it breaks Lara's standard activities down into turn-based versions, playing more like a game of chess than all out adventure. It's certainly a gorgeous isometric styled title, and the turn-based system is one of the better ways to play adventure games in a pick-up-and-put-down mobile way.

And The Winner Is.... Her Story

Remember FMV? Adding full-motion video was a way of making a game more impressive than it was in the mid 90s (see *Night Trap*). *Her Story* is a bit reminiscent of this, in a crime story for the serial podcast generation. You get to watch interview tapes and review evidence relating to a missing person / murder case as though you're the investigating officer. It's been a polarising game, some seeing it little more than watching a video in the wrong order, but others have praised it as harnessing the power of the mobile medium.

All these games demonstrate that innovation is alive and well in mobile gaming today, in many ways mirroring the early days of games development before the age of the billion dollar blockbusters we have today. 2015 was a good year for mobile games, and 2016 promises to be flashier, prettier, faster and hopefully, just as exciting and innovative as before too.

BRITISH ACADEMY GAMES AWARDS

Mobile

Smarter Than The Average Bear?

Andrew Unsworth marvels at the amount of technology now used in schools

Remarkably, considering the amount of whinging I do about it, I've spent much of my life in education. Indeed, a quick back-of-the-Excel-worksheet calculation tells me I've put in a whopping 29 years, not counting playschool, which is remarkable for someone who still claims to be 20-something when buying his mum a bottle of Scotland's finest at the local supermarket. By my dodgy reckoning, this means I would've read The Complete Works of Bangers and Mash by the point of conception and learned that dogs can't breath underwater by the time I started using the toilet. No wonder I spent much of my school life trying to mount the electric pencil sharpener and chewing on crayons. I wasn't backward, I was just bored.

As it happens, I am older than I look, and much of that time was spent working in education rather than benefitting from it. As for why my mind has turned to the theme of education, there are a couple of reasons. One is the fairly recent announcement that the nation's Year 7 children (those who are in their first year at a secondary school) would be given a BBC Micro Bit for free. I think this is a great idea, but I worry that it's impact won't be as great as it could be. I'm still unsure if it's just those children who were in Year 7 during the 2015-2016 school year that will get one or all those who enter Year 7 in subsequent school years. Is this a long-term project? I hope it is, but if not, it means that the BBC Micro Bit will benefit only a small section of our schoolchildren.

Another reason for my education-focused thoughts is the wealth of technology that is now marketed at schools and the number of technology companies vying for some of the sector's cash. There are companies that sell information management systems that form the administration and assessment backbone of our nation's schools, companies that sell the computing hardware used in the classroom, and companies that sell high-end displays and interactive whiteboards, among many other things. If there's a use for it in education, there's a technology company making it.

The BBC Micro Bit isn't the only computer aimed at school children. The Raspberry Pi is very much focused on giving schoolchildren a meaningful grounding in the way computers work, and there were a few companies capitalising on this at a trade show I recently attended. These companies gave practical demos of small-scale engineering projects and other classroom activities, with the purpose of enthusing teachers and showing them how the Pi can benefit children's learning. An article on our sister website Alphr (**tinyurl. com/zl8vln3**) reports that Raspberry Pis are going unused in schools, because children find them too complex, but the article hails from the start of 2014, so I'd hope that things have improved since then. Indeed, I'm sure that as teachers' familiarity with the Raspberry Pi has increased, so has their ability to communicate how it's used

and to come up with fun projects for their charges to undertake.

Teachers treated computers with suspicion and sometimes downright hostility when I was at school in the 80s and 90s, and I'm sure many of you had the same experience, but that's because home computing was still at a nascent stage and computers had still to infiltrate the workplace in the way they eventually had at the turn of the millennium. Not many people could grasp just how important computing was to become and how important it was to have good computing education in place. Thirty years later, we have teachers entering the profession who have known nothing but the computer age, and they have the tools to not only pass on knowledge but enthuse the generation that will follow them.

Britain has the means to dominate this technological age, and next week I'll be running through a few more education-focused goodies. Perhaps for this generation of children, school really is the best years of their lives.
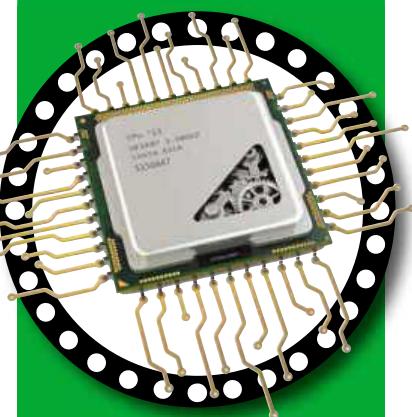
Andrew Unsworth has been writing about technology for several years, he's handy with a spanner, and his handshaking skills are second to none
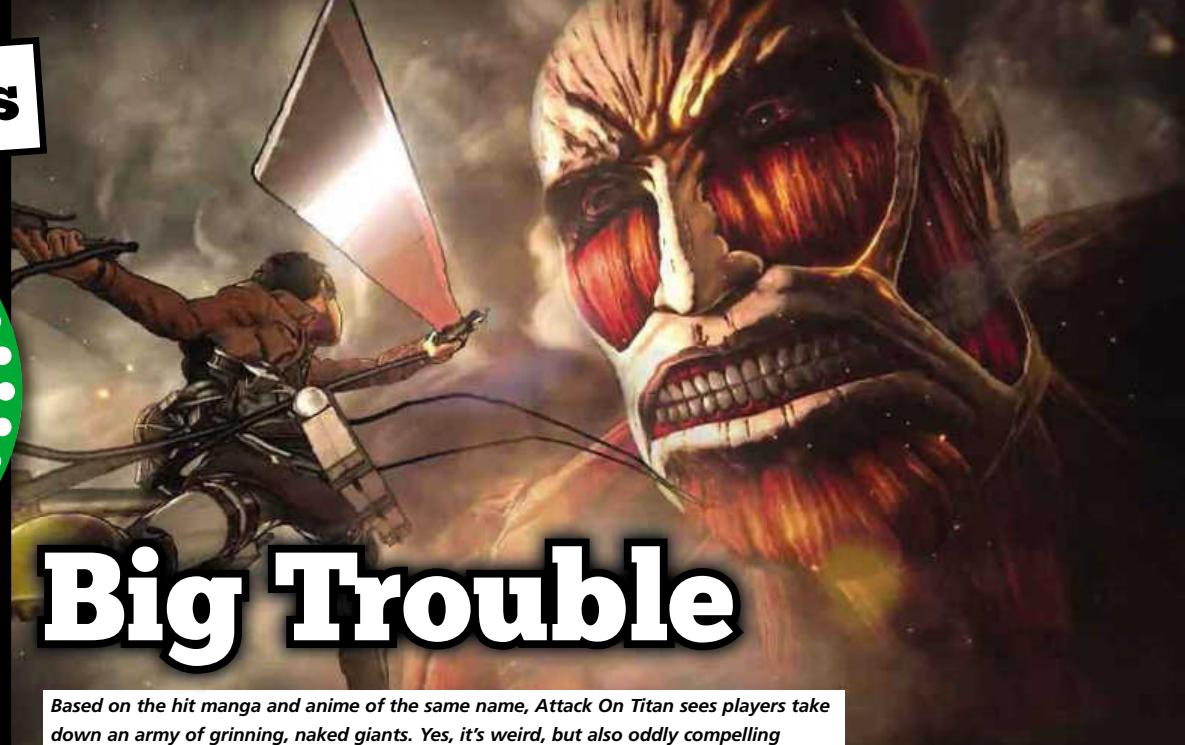
Hardware

Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Gaming

Big Trouble

Based on the hit manga and anime of the same name, Attack On Titan sees players take down an army of grinning, naked giants. Yes, it's weird, but also oddly compelling

This week, Ryan takes a look at the manga and anime-based videogame Attack On Titan, and checks out the abrupt cancellation of the Legacy Of Kain spin-off Nosgoth...

Plug & Play

Humanity is no longer at the top of the food chain. Huddled up in walled cities, earth's population lives in perpetual fear of being eaten by 100ft-tall, grinning, profoundly naked giants.

This is the faintly surreal backstory behind *Attack On Titan*, a phenomenally successful manga that has spawned an animated television series, a live-action feature film and a number of tie-in videogames. Like a combination of Robert Heinlein's sci-fi novel *Starship Troopers* and a famous oil painting by Goya, *Attack On Titan* sees a group of young military recruits charged with protecting their city from these towering menaces, which regularly attempt to break through the metropolis's fortified walls.

To even the odds, the soldiers are equipped with something called the Three-Dimensional Maneuver Gear – a motorised pulley system that allows them to swing and swoop around the city like steam-punk Spider-Men. Using this fancy tech, the soldiers can fell the invading titans: with razor-sharp samurai swords in hand, they have to attack the giants' sole weak spot: a single point at the back of their necks.

That's the premise behind *Attack On Titan* – both the story and also the forthcoming *Attack On Titan: Wings Of Freedom* videogame. While tie-in games based on the series have been mediocre at best so far, *Wings Of Freedom* has fared much better according to reviews coming out of Japan. Developed by Omega Force, the team behind the *Dynasty Warriors* series, the game reportedly stays faithful to the source anime's story – even mimicking its hyper-stylised art – while at the same time working out a satisfying means of placing the 3D Maneuver Gear in the hands of players.

In essence, *Wings Of Freedom* boils down to a hack-and-slash action game with a hint of strategy. The player's task is to take out the titans threatening the city while at the same time protecting their fellow soldiers. This is achieved by keeping an eye on the map to see where titans are heading in from, prioritising which ones to take out first and potentially breaking up small groups of titans so they're easier to take out one at a time. Although your gear makes you nimble, you're still highly vulnerable to the giants' vicious teeth.

That *Attack On Titan* is being localised for Western release at all suggests that publisher Koei Tecmo has a certain amount of confidence in it. The premise itself is an engagingly bizarre one, so if Omega Force really has affixed it to a satisfying game, *Wings Of Freedom* could prove to be that rarest of things: a licensed game that's actually worthy of our attention.

Attack On Titan: Wings Of Freedom is out on 26th August.

Online

The *Legacy Of Kain* series of fantasy action games has been around for about 20 years, with *Blood Omen* kicking off the franchise in acclaimed style in 1996. In more recent years, however, *Legacy Of Kain* hasn't exactly had a lot of luck. *Dead Sun*, a promising-looking single-player sequel was cancelled in 2012 after about three years in development. Publisher Square Enix then attempted to salvage at least some of the work on that game by having its multiplayer mode, christened *Nosgoth*, spun out into its own stand-alone title.

Three years later, and it's now emerged that *Nosgoth* has also gone the way of the dinosaur. The news came from the game's website, where

▲ After three years in development, Nosgoth has suddenly been cancelled. It's the second Legacy Of Kain game in a row to have its plug pulled

developer Psyonix announced that *Nosgoth* is to go offline on 31st May. "It's been a pleasure to build this game with your help," an update reads, "but ultimately its audience hasn't grown enough to sustain ongoing operations."

Only loosely based on the main *Legacy Of Kain* action-adventure template, *Nosgoth* was instead a third-person shooter where teams of humans fought against an army of vampires. Where humans have the benefit of crossbows and other powerful weapons, the otherwise unarmed vampires relied on speed, agility (including the ability to fly or scale walls) and the brutal power of their teeth and fangs.

Nosgoth appeared on Steam Early Access last year, where it received an enthusiastic response among players. As recently as last month, things seemed to be progressing as normal; *Nosgoth*'s range of maps had steadily grown from the mere three it had at launch to a more healthy six, and Psyonix had even

suggested that it was putting the final touches on the game before its proper release.

"We haven't announced a date for [release]," designer Bill Beacham told Eurogamer in March 2016. "We're just going through a final stage of bug fixing and quality control to make sure when we do go out of Early Access, the game is as robust as it can be."

Yet, less than a month later, on 8th April, the plug had been pulled on *Nosgoth* – which rather suggests that the decision came from publisher Square Enix rather than Psyonix itself. Psyonix hasn't said as much, of course. Its brief statement simply says, "This was not an easy decision to come to."

As for the main *Legacy Of Kain* series, its future seems clouded. When asked about the series, Square Enix simply said, "Any future *Legacy Of Kain* project will be considered independently of *Nosgoth* and on the merits of the proposals alone."

Nosgoth will still be available to play until the end of May, until

its servers are sadly shut down for good.

Incoming

Mirror's Edge was by no means perfect, but it certainly showed a lot of promise. Thankfully, nearly nine years after the rooftop running sim was released, it's finally been given a chance to realise its full potential. *Mirror's Edge Catalyst*, due out next month, is both a prequel and a reboot of the original game – an extension and refinement of its unusual first-person parkour action. The disappointing shooting elements from the first game are gone, replaced by a more detailed set of hand-to-

hand fighting moves, while the original's linearity has switched to a free-roaming design where you're free to tackle missions as you see fit.

At the same time, EA Dice hasn't attempted to fix the aspects of the game that were never broken in the first place. The agile heroine Faith Connors is still using her skills to bring fight an oppressive future regime, and Dice is still concentrating on bringing that flowing, almost zen-like quality to the running and jumping that made the first game so exhilarating in its best moments.

Mirror's Edge Catalyst is out on 26th May.

▲ Faith is back in the rebooted Mirror's Edge Catalyst. Expect plenty of rooftop pursuits and death-defying leaps when it arrives on 26th May

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Tel: (07949) 407022 Email: tape.20. odaily@spamgourmet.com

WANTED: You bought a Corsair water cooler, with a square block. You fitted it to your Intel processor. You want to make a few pounds from the spare A.M.D. bits? Contact me!
Email: johnrpeel@gmail.com

WANTED: Gigabyte GA-Z77X-D3H motherboard wanted.
Email: johnbeiry@gmail.com

WANTED: PC Tower case (beige colour if possible) to rehome an Amiga A1200 vintage computer. The Amiga motherboard is H 410mm x L 190mm (H 16" x L 7.5"). PSU not an issue but if available 250 watt more than enough.
Tel: Bill (07742) 061569 or (02641) 769503.

WANTED: 3G dongle for Archos 80 G9 tablet.
Email: alancox28231@gmail.com

SOFTWARE FOR SALE

Sim City 2000: Boxed and original. Classic gaming. £15.00
Tel: Gordon (01314) 660205 Email: scobieg09@gmail.com

Adobe Photoshop Elements and Premiere Elements 12 Full Version - Windows/Mac. Original Boxed CD with unused product key. £47.50
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

PCB design software. 127 layers, schematic entry, PCB entry, PCB to Gerber file converter, output to printer. £9.99
Tel: Nigel Wright (07967) 527693
Email: cresswellavenue@talktalk.net

Microsoft Office 2013. Original Software only £100.
Tel: Gordon (01314) 660205
 E-mail: scobieg09@gmail.com

Cyberlink PowerDVD 12 Standard. Runs under Windows 8, 7, Vista or XP. Original CD with unused product key £7.50
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

Nuance Omnipage 18. OCR; Windows 8, 7, Vista or XP, Original CD with unused product key £25.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

Acronis True Image Home 2012. Bootable CD. Application runs under Windows 8, 7, Vista or XP. Original Acronis CD with unused product key £5.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

Norton Family Premier 2.0. Runs under Windows 8, 7, Vista or XP, Original Symantec unused product key £15.
Tel: Ian (01932) 856971
Email: a2345@btinternet.com

SOFTWARE WANTED

Good Text to Speech program WinXP or 7 to read ebooks aloud for a pensioner with few resources.
Tel: Wilf James (01767) 699809

Wanted: PictureToExe software, for making picture shows.
Tel: (01202) 610602
Email: ivor.mary@talktalk.net

Wanted: Quicken 2001. I desperately require a copy of QUICKEN 2001, UK Edition. I need to reinstall the program but have lost my original installation CD.
Email: david.maddams@icloud.com

XP Classics

I have finally decided that, after 10 years of using my current Core2Duo (o/c to 3GHz) desktop set-up, that it's time to consider a major upgrade.

As I more or less exclusively use Linux Mint for my general duties, it is not an upgrade in processing power I'm after, but the upgrades to USB3 (natively) and SATA3. M2 would be nice too, a I do use SSD for OS, USB3 caddies to backup my NAS and have Raspberry Pi's taped to all our TV's!

After trying to convince myself I needed an i5, I came to my senses and started looking at an AMD APU set-up. The newly announced A10-7890k (including the Wraith cooler) and a forty quit FM2+ board look pretty good to me.

I'll need DDR3 RAM too, but I will still likely get change from £200 and most of my 'bells and whistles'. I'm nearing 60, and I haven't bought a new release PC game in many years.

Anyway, to the question I want to ask! I've read that FM2+ APU's do not support Windows XP 32-bit installations. Does that mean that my days of playing *Tiger Woods*, *World Championship Snooker*, *Need4Speed* and a few other great distractions, that I keep an XP loaded hard-drive for, will go? Or is there some way to virtualise round this problem from Mint 64bit Cinnamon?

Love the experts columns and the 'Grumpy old man' Logging Off!

Dave

As far as I'm aware, there don't seem to be any specific problems with the FM2+ line and

Windows XP 32-bit. I've seen some people running the CPU with the OS, so I'm not sure what information you've seen. However, PC setups are all different, so there may be some form of configuration that causes problems with the older OS. Because of this, you may find you'll be fine, and don't need to worry.

> 66 **Virtualisation is always a good problem solver here** 99

If you do run into problems, however, virtualisation is a good problem solver here, and the always recommended VirtualBox can help out. As well as versions for Windows, the virtualisaton software has various installers that can allow you to use Linux, including Mint. You can find plenty of details of these over at **www.virtualbox.org/wiki/Linux_Downloads**, where there's a collection of downloads for various distros – including instructions for specific breed of Linux.

Using one of these installers, you should easily be able to install and run a virtual Windows XP 32-bit system so you can run your classic games with no problems and have the best of all worlds.

▼ *VirtualBox can run on various forms of Linux, including Mint*
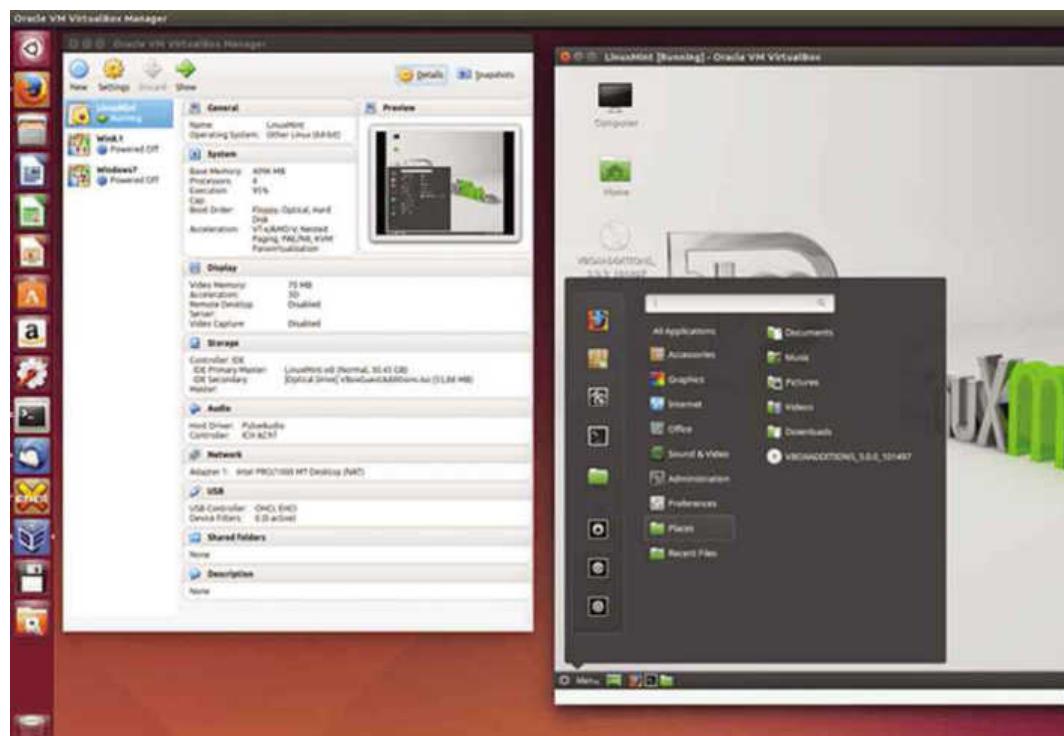
Overkill?

I need to get on with the task of converting and editing our family film archives-from my father's Kodak Standard 8 cine, through reels of Sony Hi-8, then VHS cassettes, and on to modern camcorders. I intend to get all the different formats professionally converted to DVD/disc etc, ready to be edited on my PC using Adobe Première Elements, or a similar type of software programme. The problem is that my eight years old Dell Inspiron 530/Vista powered PC is surely unfit for purpose, but I'm not sure what I need to replace it with.

Micro Mart 1383 featured a group of video editing software programmes. The PC used as a test rig contained Intel core i7, 16GB memory and GTX970 GPU, which are the kind of components found in a top level PC. Do I really need a games machine just to edit my videos? The machine would otherwise just be needed for e-mail,web-browsing, playing music and photo storage, personal office tasks etc.

On the other hand, should I be looking at this stage for an opportunity to secure a good level of future-proofing in my choice of components? I feel this could be worthwhile, and was something I have overlooked in the past. In this case, would I be wise to consider the latest technology such as Westlake/DDR 4 memory/a suitable GPU card/SSD memory up to 250GB? One or 2TB storage hard disc?.

Unless there is a suitable system for me to buy on the shelf somewhere, I would probably ask someone to build one to my specification. I would normally enjoy the prospect of building my own PC, but would no doubt struggle with software problems.

If you do have any views that would help me to move forward on this, I would very much appreciate your opinion.

Anthony

Video editing is one of those strange PC tasks that flies in the face of expectation. You'd think that simply editing video wouldn't be too demanding. The PC is hardly rendering the latest graphics, or having to handle complex code and AI, so why go for such power?

The simple answer is intensity and workload volume. Video files, especially raw video you grab from external media, can be huge, and this means the system has a mammoth amount of data to go through, often in real time. Encoding and working with these large files requires not only a large amount of disk space, but also a lot of processing power and the need for working memory space, or RAM. Without these, the system can struggle when editing video,

and this can not only result in tasks that are very time consuming, but can have adverse effects on the edited video.

If your PC isn't up to scratch, you can end up with choppy, artefact-ridden video and audio sync problems. Without enough power or RAM, the whole process can become unstable, as your PC struggles to cope with the amount of work on offer. Even powerful machines are pushed hard when converting and working with video.

temporary data that arises from the editing and conversion process. Storage is obviously needed as you'll require a ton of space when working with such large files. Fast storage is also paramount, as the data transfer when editing is very intensive, and speed is essential. SSD drives, therefore, can be a big help, although I'd always advise a good, large capacity platter hard disk for the actual storage of video.

Some video cards that feature hybrid GPU/CPU tech can help with the process,

> **❝ Video editing is one of those strange PC tasks that flies in the face of expectation ❞**

The test system used in the video editing article was not an uncommon specification for video editing use, and although it does, indeed, mirror the kind of spec a PC gamer would use, it's also power that's put to good use when working with video, which is one of the most strenuous tasks a PC can perform.

Of course, to edit video you don't need to buy the most powerful system around, and there are things you can cut corners on. For example, the actual video card isn't as important as you may think. As long as your card can playback HD video, you're set. You don't need the latest and greatest model.

When it comes to the CPU, RAM and storage, however, these are very important. The better the CPU, the easier your time will be, and the editing software you're using will perform much more fluidly. Likewise, the more RAM you have, the more space the system has to work with

and although it's not essential, such a card can also help, but the CPU and RAM will always be your most important components for the task.

When it comes to future proofing, it's always wise to try and spec a system to last as long as possible. The nature of the constantly evolving PC market makes this a difficult task, but the better your PC is at purchase, the more life you'll get out of it. That said, unless you're planning to do very in-depth editing, including complex cuts, effects and all sorts of filters, your PC doesn't have to be so powerful, and you can cut back a little, perhaps opting for 8GB of RAM instead. As long as you've got a solid base that an support a good CPU and has the option for expansion, you'll be okay.

▼ *Video editing demands a decent PC, but not all specification are equal in importance*

ASK JASON

Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs

Send your questions to:
Jason D'Allison
Micro Mart
Dennis Publishing
30 Cleveland Street
London
W1T 4JD

Contact Jason by email at:
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Memory Game

I have a Medion Akoya P6627 laptop. It's running 64-bit Windows 7 and came with 2 × 2GB of DDR3 (Hynix HMT325S6BFR8C). I've just upgraded to 2 × 4GB (Kingston M51264J90S), but the laptop won't recognise them. If I put both in, it won't start at all. What could be the problem? I've failed to find out anything about the P6627's motherboard except that it uses the HM55 chipset and the rPGA 989 socket.

Alex Mironov, Gmail

On a modern system, the motherboard and chipset usually have little bearing on RAM support, as the memory controller is built into the CPU. Still, it's always good to have as much information to hand as possible. The use of the HM55 chipset tells me, for example, that the CPU must be a first-generation mobile Core i3, i5, or i7, or a Celeron or Pentium derived from them. All such CPUs can take 8GB, split over two slots.*

The problem here, Alex, is probably your RAM modules' chip configuration. We're talking banks, ranks, and density – a long story, and only marginally more interesting than the latest Dan Brown novel. In short, your Kingston M51264J90S modules use 512MB chips, so there are eight of them (512MB × 8 = 4GB), all mounted on one side. I suspect that the only 4GB modules your CPU will handle are those using 256MB chips. You'll be able to recognise these because there'll be sixteen chips (256MB × 16 = 4GB), eight per side. They do exist, but you may have to persevere to track some down.

Finally, I'm intrigued that you say the laptop doesn't start up at all when both modules are inserted. Does this mean it *does* start up when only one is inserted? That's a little odd, but perhaps not uncommon. Is only 2GB recognised? If so, that confirms what I've written above: the memory controller is accessing only the first 256MB of each chip, with the rest being effectively invisible.

* The first-generation desktop models can take 16GB (or 24GB for the Core i7-9xx series), split over four slots (or six for the Core i7-9xx series).

▼ **When fitting the maximum amount of RAM your PC supports, things can be a bit more complex than simply buying modules of the correct capacity**

Numero Uno?

I picked up an electronics 'maker' magazine the other day, and some of the projects have sparked my interest. To get started, my plan was to buy a Raspberry Pi 3, but I notice that a lot of projects use Arduino boards, usually the Uno. What's the difference? Which should I go for?

P McDermott

The Pi 3 is pretty much a full-blown personal computer (as are the other Pi models). It can run a graphical operating system (typically a Linux variant) and has video, sound, USB ports, wi-fi, and all the rest. The core system has some serious power, as shown below.

- **CPU:** 1.2GHz ARM Cortex-A53 (quad-core, 64-bit)
- **RAM:** 1GB
- **Storage:** up to 32MB via micro-SD; more via USB

By contrast, the Arduino Uno (in common with the other Arduino models) is merely a microcontroller. It's still a computer, but there's just a CPU, some RAM, and some storage – no video, sound, or other niceties. It can't run a graphical operating system. As shown below, the core specs are lower than found in some pocket calculators.

- **CPU:** 16MHz ATmega328 (single-core, 8-bit)
- **RAM:** 2KB
- **Storage:** 32KB (plus 1KB of EEPROM)

The way to go depends on your project. If you're building something that requires any kind of grunt, or user interaction via a screen, you'll need a Pi. If you're building something truly embedded – it just works, and at most requires the user to press a button or two – an Arduino is probably better.

To give some examples, an Arduino could be used as the basis for an intrusion alarm, a set of fancy Christmas lights, a motorised garage door, a temperature display, or an avoidance or line-following robot (very popular). If the project involves

a sensor and a motor and little else, think Arduino. Of course, a Pi could be used too, but it would be overkill. Furthermore, a Pi is normally powered by a Micro USB phone charger, whereas an Arduino just needs 3 × AA batteries.

As you say, the Uno is probably the most common Arduino. You can pick one up for about £3.99, or just £1.99 if you order from China. Try eBay. The Arduino platform is open-source, so anyone can make compatible boards – there's no need to buy from the actual Arduino company (prices are higher). At around £30, the Pi 3 looks expensive, but of course it's far more complex and can do a lot more things. Horses for courses.

Something else to consider is the programming language. Are you a coding novice? Both the Pi and the Arduino can be programmed using any language for which there's a compiler (or interpreter), but the official language for the Pi is Python, which is pretty easy to learn. For the Arduino, it's C++ (or, heaven help us, C). That's a tougher prospect – it remains the language of choice for professional games programming, for instance.

➤ *For many projects a Raspberry Pi might be overkill – an Arduino could suffice*
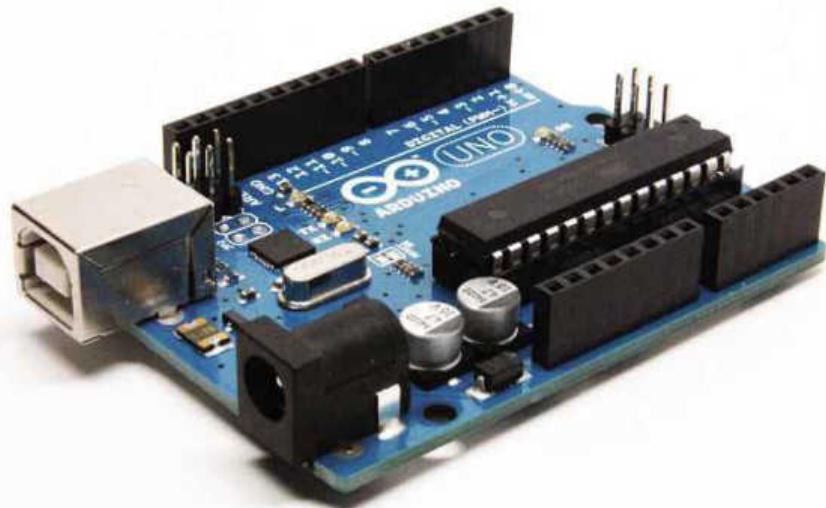
Share This Post

Now that my children have started school, I'm in the job market. On my CV I've been putting my email address, but this is a generic and unprofessional-looking Gmail address. How easy is it to set up a 'proper' address, and how expensive?

Mary, Gmail

*Doing this is a doddle, Mary. First, you need to buy a domain name – a web address, basically. There are lots of companies out there selling these, but as examples, try **www.1and1.co.uk**, **www.domainmonster.com**, or **uk.godaddy.com**.*

Domains are leased rather than owned, so you'll pay a fee every year. Looking at yearly costs with 1&1, a .com name is £10.99 (99p for year one), a .co.uk name is £6.99 (£3.99 for year one), and a .net name is £11.99 (£6.99 for year one). Of course, there are hundreds of other domain types (TLDs – top-level domains) – maybe you fancy .vodka, .hiphop, or .ninja?

The next step is to set up email forwarding, a service most domain companies include for free (double-check!). There'll be an admin portal you can log into, and from there you'll be able to specify an email alias (or several) – numpty@mynewdomain.com, for example. You'll also need to specify a forwarding address – your existing Gmail address. From then on, whenever someone sends an email to your new address, it'll be automatically forwarded to Gmail. If you get fed up with Gmail and want to move to Outlook.com, just log back into the domain company's portal and change the forwarding address.

Now, when you send messages or reply to them, you may want people to see that they've come from your new address, not from your Gmail address. Setting that up is a little more involved. In Gmail, click the cog icon and select Settings. Hit the 'Accounts and

Import' tab. Under 'Send mail as', click the link called 'Add another email address that you own'. In the new window, enter your real name, your new email address, and untick 'Treat as an alias'. Then click Next Step.

This is where things get tricky. First, you'll need to enter the SMPT server name for your domain company – this'll be in the company's help pages somewhere. Next, you'll need a password. To get that, you'll probably have to log into the company's admin portal again and set up a basic mailbox (which should be free). For the username, enter your new address in full – both the domain part and the bit before the '@' symbol. Finally, Mary, once you've clicked Add Account and you're back on the 'Accounts and Import' tab, select 'Reply from the same address to which the message was sent'.

▼ *Buy yourself a domain name and you can keep the same (professional-looking) email address for life*

Crowdfunding Corner

It's been a while since we looked at the gaming offerings available on Kickstarter, so this week we're doing exactly that, with this pair of cool-looking, retro-inspired PC games that need your help to happen

Mable & The Wood

This 2D action/exploration game is set in a world where the overuse of magic is draining the colour from everything. You play Mable, a shape-shifting girl who can take the form of any beast she slays – but whose magic abilities are destroying the world she's trying to save. Your quest is to find the source of the darkness consuming the forest before you become it yourself.

Already given favourable coverage within the indie games realm, *Mable & The Wood* is full of innovative mechanics that make it original and fun to play. Combat is movement, so different attacks help you traverse obstacles and uncover secrets depending on how you use them. An overworld map gives you the ability to play the game at your own pace – you can unlock different abilities in different areas.

We are promised loads of different bosses and enemies to fight with superb environments and animation to enjoy, and it should all adds up to many hours of fun. You can get a copy of the game by pledging just £7, which also includes exclusive wallpapers and your name in the credits. Higher tiers include an art book, soundtrack and beta access. Delivery is estimated for February 2017 and it's already halfway towards its goal with plenty of time left – so fingers crossed!
URL: kck.st/1TT89U5
Funding Ends: Thursday, 28th April 2016

LUNA - The Shadow Dust

Luna – The Shadow Dust is a simple point-and-click game that looks to have been made in the vein of recent indie classic, *Machinarium*, with incredible hand-drawn graphics and simple icon-based interaction. You control a boy on a quest to bring back the moon, recover his lost memories and restore the world to prosperity with the help of friends, pets and other characters along the way.

The game sees you controlling two different characters to solve puzzles, which are presented as animations and visuals rather than text. There are loads of cinematic animations stitching the story together, and a huge selection of custom-made music that'll feature on the soundtrack. Even from the early videos that are available, it looks like it's going to be great.

The game is planned for release on Windows, iOS and Android, and you can get a copy by backing it for just £7. You can get the soundtrack or a digital art collection by paying £15, or both for £25, and beta access for £50. More exclusive rewards are available at even higher tiers, too! If you're unsure you can play a demo version linked from the Kickstarter page, which should whet your appetite. Delivery is planned for March 2017, and again it's well on the way to hitting its target – but your help is certainly needed to tip it over the fence, so if you like the look of it don't wait!
URL: kck.st/1qU5xdr
Funding Ends: Monday, 2nd May 2016

Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

WebTorrent Desktop

A new way to stream online content

Torrents may well be one of the more popular methods of obtaining illegal software and other copyrighted material, but they're also often used for more legal sharing of content.

We won't go into the legality of torrents here, but what we do have is an app that allows you stream a media torrent before it's downloaded. It's very similar in technology to the Torrent Time plug-in that appeared earlier in the year – sadly implemented by the Pirate Bay. But while Torrent Time focused on illegal content, WebTorrent Desktop instead is hoping for a more acceptable method of peer-assisted delivery.

Streaming Via Your Browser

Whereas Torrent Time was a plug-in that required both the client and the server side to support it, WebTorrent Desktop is the client side of the newer JavaScript technology that allows content to be streamed without it needing to be downloaded.

It's still in the beta stage at the moment, but it's available for Windows, Mac and Linux.

The client works in much the same way as the web plug-in, in that it uses magnet links as well as torrent files to stream movies, music and even e-books.

It also features some pretty interesting technology, whereby you can skip forward or back through streaming content without the entire file being downloaded. This works by the client prioritising the pieces that are being fetched from the network and either pushing a new piece through or dropping others depending on what a user demands from the client.

Obviously there's the issue of the client being used for illegal purposes, but as the founder and developer Feroos Aboukhadijeh says, "One of the most exciting uses for WebTorrent is peer-assisted delivery. Non-profit projects like Wikipedia and the Internet Archive could reduce bandwidth and hosting costs by letting visitors chip in. Popular content is served browser-to-browser, quickly and cheaply. Rarely accessed content is served reliably over HTTP from the origin server."

Features At A Glance
- 100% open source.
- Stream content to AirPlay, Chromecast and DLNA.
- Open magnet and .torrent links.
- Lightweight and easy to use.

Thinking Of The Future

WebTorrent Desktop seems like a great resource for those of you who want to stream legal torrent based content. It's quick, easy to use and a powerful tool to have at your disposal.

However, we're wondering how long it'll take before the powers that be declare a cease and desist on the project, since it'll inevitably be used by those who want to watch the latest movies and other copyright-breaking content. It's a shame, but that's the world we live in. All we can do is support it for what it's worth and wait to see what happens.

If you're interested in giving it a go or learning more, then you can find everything you need at **goo.gl/U1TRDC**.
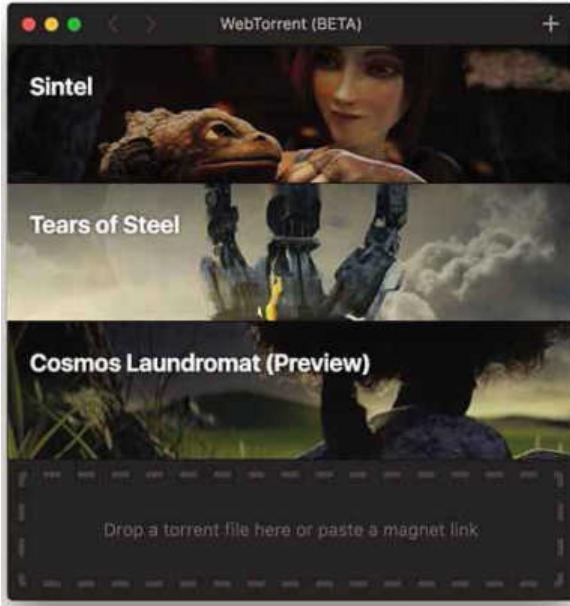
⌃ *The interface is simple and easy to use, and you can drag and drop any link directly into it*

⌃ *Skipping through the content is possible due to a prioritised piece technology*

Logging Off

Previously, I've cut Google some slack that I might not have given to Microsoft and Apple, but not this week.

Just 17 months ago, Google, via its subsidiary Nest, bought an innovative company called Revolv, which has developed a home automation hub of the same name. Then a few weeks ago, it declared that it would be ending that product. And I'm not talking about in years' time. It dropped the guillotine on it practically overnight.

It didn't even send an email to the Revolv Hub customers. Instead, it just put up a page on the Revolv.com website that succinctly said, "We're shutting down Revolv."

That was followed by this remarkably curt information:

"What happens to my Revolv service?
"As of May 15, 2016, Revolv service will no longer be available. The Revolv app won't open and the hub won't work.
"Is my product still under warranty?
"No. Our one-year warranty against defects in materials or workmanship has expired for all Revolv products."

Wow. 'Don't let the door hit you on the way out' was the only helpful comment missing here.

In any industry other than the tech one, ending a product is just that. They stopped making Messerschmitt three-wheeled cars, they stopped making the Avro Vulcan, and a million other things that impressed people.

But Revolv Hub only works because it interfaces to an internet based server, and with the product discontinued, Nest immediately turned that off. This was effectively a remote kill switch, making the $300 devices instantly junk, even if people had bought it with the knowledge that it had a 'lifetime subscription'.

This sets a very poor precedent, because no Revolv owner would replace their tactically nuked device with a Nest one, with the full knowledge of the sort of customer loyalty that they might realistically expect down the line.

What makes this even more galling is that under US and UK law, it is illegal to circumvent the DRM in the Revolv Hub, so it's impossible for a third party to step in and provide a service or for those who are technically minded to make it operate independently. Therefore part of the reason that Google and Nest feel comfortable about doing this is

they know that once they've killed these devices, they won't be coming back to haunt them anytime soon.

Yes, but as Apple and Microsoft have both concluded, there is no get-out-of-jail card that works 100%. While DRM might legally allow them to stick two fingers up to Revolv's customers, it isn't without some cost, if only in reputation.

The idea that it is entirely legal for a company to disable a product you bought and own for its own nefarious reasons is completely unacceptable, however they spin it.

What the buying public needs is protection against this sort of activity, so either the company involved promises to run the server side for at least ten years past the point the product is discontinued.

Having companies get people to buy into an infrastructure that they then intentionally make obsolete just isn't acceptable, and they need to be held to account.

Trust is a rare enough commodity in the technology sector – something Google may well discover if it keeps on making these kind of aggressive choices.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Milton Babbitt, **8** Retail, **9** Strict, **10** Eclipse, **12** Sneak, **14** Glide, **16** Pontoon, **19** Jumper, **20** Scribe, **22** Numerological.
Down: 1 Wire, **2** Strati, **3** Analyst, **4** Lapse, **5** Oberon, **6** Staccato, **11** Calculus, **13** Hotspot, **15** Duplex, **17** Toroid, **18** Arrow, **21** Bias.

THIS WEEK'S CROSSWORD

Across
7 Body of water lying between Europe and Africa to the east, and North and South America to the west. (8,5)
8 A mythical spirit that lives in or frequents the woods. (6)
9 Members of a race of hostile alien machine-organisms, which appeared in the television series *Doctor Who*. (6)
10 The tendency of a body to maintain its state of rest or uniform motion unless acted upon by an external force. (7)
12 An important question that is in dispute and must be settled. (5)
14 .it TLD. (5)
16 A program that uses a unique artificial intelligence algorithm to converse with humans @#. (7)
19 This influential Romanian mathematician made an important contribution to the introduction of computers into Romania. (6)
20 The upper house of the United States Congress. (6)
22 A floristic kingdom comprising tropical areas of Africa, Asia and Oceania (excluding Australia and New Zealand), as proposed by Ronald Good and Armen Takhtajan. (13)

Down
1 If you like being in the EU, this is how you should vote. (4)
2 The voluntary relinquishment or surrender of some known right or privilege. (6)
3 A thin sheet of material with a pattern cut out of it; used to produce the cut design on the surface below by the application of ink or paint through the holes. (7)
4 A motor vehicle engine diagnostic result displayed by an OBD-II scanner. (1-4)
5 Instruments for measuring weight. (6)
6 Oracle CEO. (4,4)
**11** Not based on fact; unreal. (8)
13 Condition in which the earth's surface is worn away by the action of water and wind. (7)
15 Relating to or denoting companies whose shares are quoted on the main market of the London Stock Exchange. (6)
17 An input socket in an electrical device. (4-2)
18 C++ class library for scientific computing. (5)
21 There's no 'I' in this word as my more enlightened work colleagues used to keep on telling me. (4)
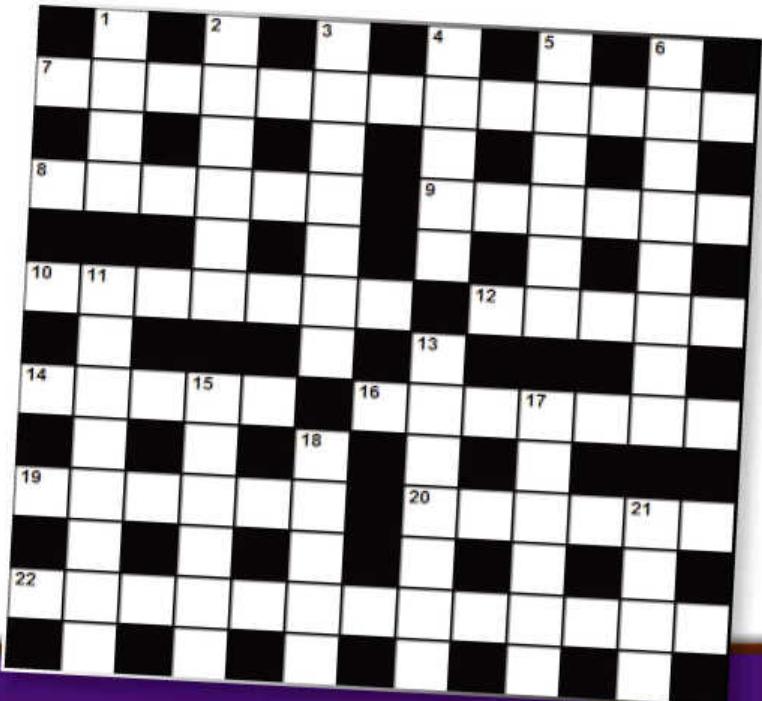
Top 5 Things To Take On A Manned Trip To Mars

You're going to be there for the rest of your life, so get comfortable…

1 An E-reader

Assuming the Mars One mission isn't just a big lie (**goo.gl/ DZP30A**), those who find themselves on the way to the Red Planet will have a lot of time to kill: seven months, more or less. Even if you get on with your crew mates, it would still be a good idea to take along a few books to read. Space will be limited, of course, so you can't drag along crates of paper books, which makes an ereader the perfect companion for such a long trip.

Just remember to load it up with books before you go. We're no experts on space travel, but we're pretty sure the wi-fi out there is terrible.

2 A Handheld Console

As well as an e-reader, we'd also suggest that Mars-bound individuals take a games system with them too, just for a change of pace. As with books, though, you don't want to take a bunch of hard media with you. Also, you don't want to limit yourself to the games of just one system. After all, it's not like you can pop down to Argos and pick up a new machine when you're bored. For that reason, the best thing to take would be something that can run emulators, because that way you have access to several decades worth of games systems and games. Something like the OpenPandora or one of the many JXD devices could do the trick.

As for the games, you really shouldn't download ROMs unless you own the originals, but you're headed on a one-way trip to another planet. The arm of the law may be long, but it's not that long.

3 Batteries

Whether you're running an e-reader or a Game Boy, you're going to need power. Presumably the ship you're on will have a power source, but you don't want to be tied to a plug socket all day, especially when you're roaming the rocky plains of Mars. That's why you need to take batteries – and lots of them too.

It would also be a good idea to take rechargeables, because you won't be able to buy new ones, and you also don't want to make your mark on your new home by scattering spent batteries everywhere.

Whatever you do, don't buy cheap ones from the pound shop, because they'll all be used up before you've even made it past the moon.

4 Solar Battery Charger

Like we said, the Mars missions will undoubtedly have some kind of power source in place, but we imagine there are probably strict rules about using such limited resources to play *Sonic the Hedgehog*. For that reason, it would be a good a idea to take your own personal solar battery charger. These can be found fairly easily online, and some of them can even charge standard AA cells, which is perfect for all your consumer gadgets.

Of course, you could be less environmentally friendly and take a fuel-based generator of some kind, but good luck finding anything to burn.

5 Lots Of Ketchup

Okay, this one isn't technology related, but that doesn't mean it isn't important. As we learned from the completely scientifically accurate Matt Damon movie *The Martian*, when you're stuck on the Red Planet eating potatoes grown in your own poo, the one thing you don't want to happen is for your tomato sauce supply to run out.

Of course, there's no easy way to compress ketchup, so it's going to take up a fair bit of space. But considering how much room you'll have saved with your e-reader, handheld games machine and rechargeable batteries, it should be a doddle to convince the bosses to let your take a decent supply of condiments.

⌃ In spite of its colour, there is almost no ketchup on Mars